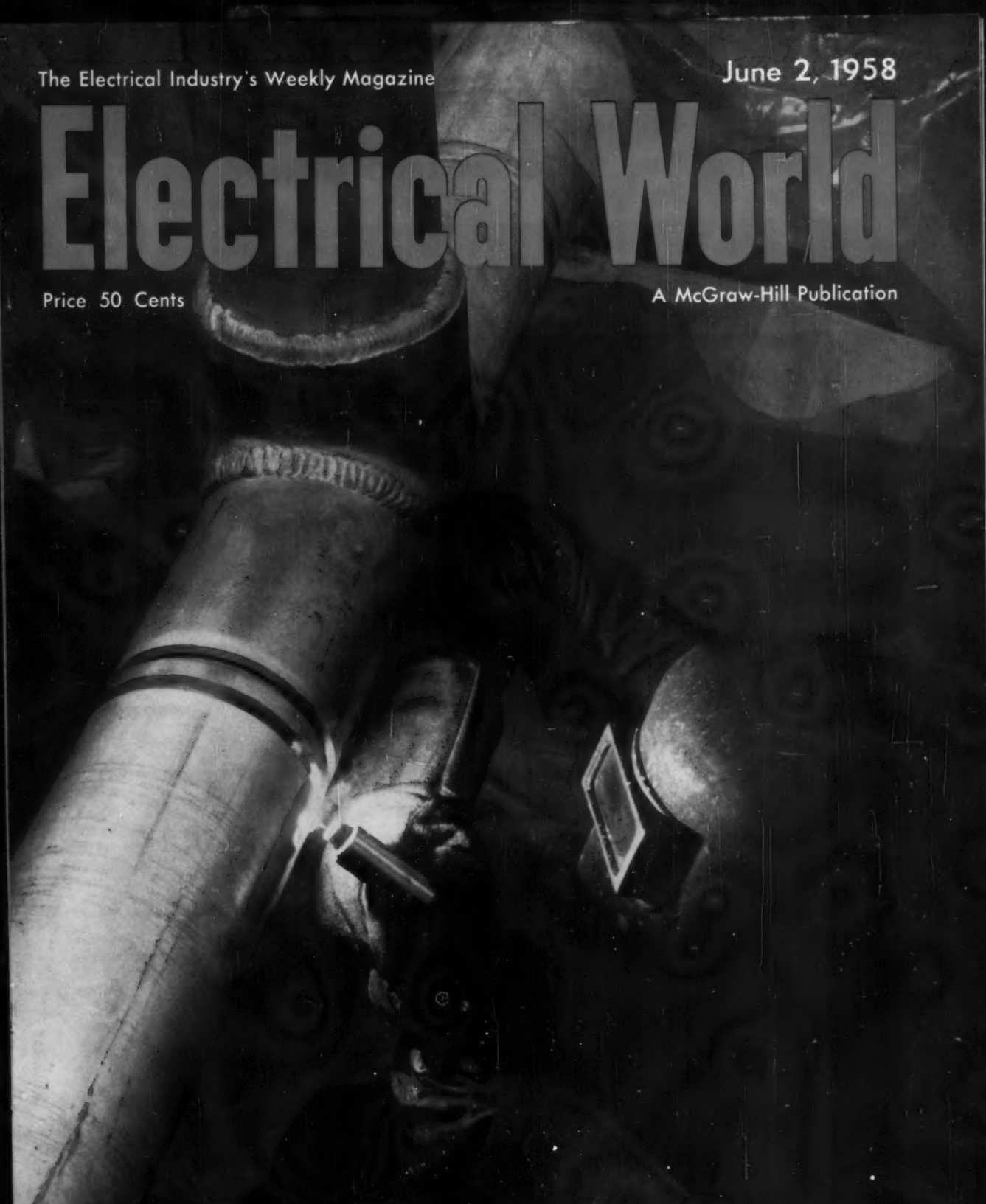
The Electrical Industry's Weekly Magazine

June 2, 1958

Electrical World

Price 50 Cents

A McGraw-Hill Publication



½ Million Kva on Aluminum Buses ... p 40

Shippingport Dedicated ... p 40

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How OPERATION UPTURN can benefit electric utilities

OPERATION UPTURN BUILDS LOAD

OPERATION UPTURN OFFERS OUTSTANDING VALUES

As a dramatic demonstration of its confidence in the nation's economic strength, General Electric recently announced OPERATION UPTURN—a Company-wide program designed to help speed the upturn in business. This program marshalls all of G.E.'s management and technical skills and brings them to bear on the challenging task of encouraging customers to buy NOW for extra values. In addition to utilizing new business strategy and aggressive marketing techniques, Operation Upturn enlists the support of 221,000 employees, 385,000 share owners and hundreds of thousands of natural sales allies—dealers, distributors, suppliers.

BUILDING SALES AND JOBS—Operation Upturn is one common-sense answer to current business problems. It further stimulates an economic chain reaction (1) to help revitalize employment and the business climate; and (2) to encourage industry to get on with long-range plans tied to needs of growth years ahead.

BENEFITS TO ELECTRIC UTILITIES ARE TWOFOLD

- **Building load**—By encouraging consumers and industries to purchase electrical goods now, Operation Upturn helps build new loads for electric utilities, thus making possible immediate power sales for utilities to offset declines in other power consumption categories.
- **Outstanding values**—Operation Upturn re-emphasizes the outstanding extra values and up-to-date products General Electric offers utility companies today. With prosperity linked directly to inevitable population increases, electric utilities can gain important advantages by carrying forward . . . NOW . . . their long-term construction programs on a steady basis at today's favorable prices.

FOR MORE INFORMATION about Operation Upturn, and what it offers in terms of your business and long-range plans, contact your nearest G-E Apparatus Sales Office. General Electric Company, Section 301-390, Schenectady 5, New York.

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 149, No. 22 JUNE 2, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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CEA Explains Explosion at Uskmouth

Traces piston seizure to unique corrosion of mechanism due to salt solution in oil lines.....p 49

INDUSTRIAL

Aluminum Bus Conductors Carry ½ Million Kva

Lawrence Pavane, F. H. McGraw & Co, Engineers & Constructors

System provides economic conversion and utilization at Ormet's new Ohio Valley aluminum reduction plant.....p 46

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Sighting Best for Sagging ACSR

Philip C. Evans, B. C. Engineering Co

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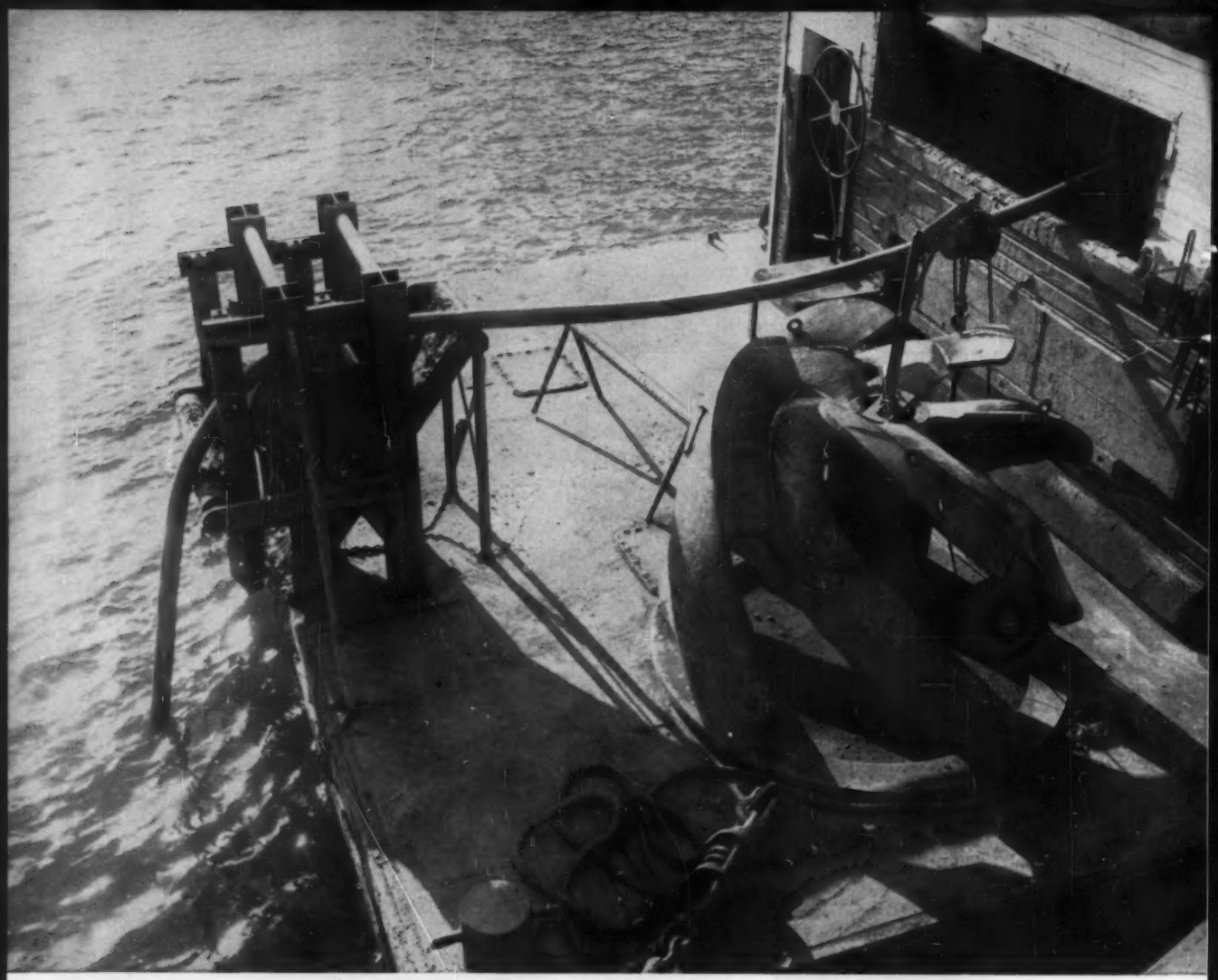

Built for a long life of hard knocks, this 4,500-foot, 3-phase, 20kv, shielded Okolite insulated cable with Okoprene sheath powers the rotary cutter head at right. Although nearly 5 inches thick, this cable has all the flexibility needed for dredging operations.

the previous OKONITE cable lasted 15 years ... but this one is built for even better service

Pacific Dredging Company has recently put into service an Okonite replacement for an Okonite 15kv armored cable that had seen fifteen years of successful service . . . two to three times normal expectancy. In the strenuous operation of cables feeding power to giant dredges from shore stations, five years' service life is considered good.

But the new cable was designed to last even longer than its predecessor. The major cause of breakdown in dredging cables has been deterioration of the armor wire, which breaks and punctures the insulation. To overcome this, Okonite engineers replaced the armor with a tough, mold-cured, reinforced Okoprene sheath. Although this construction has only been in operation for a year, Pacific Dredging Company is confident that it will outperform the old one.

This example of Okonite's constant determination to "better the best" shows why Okonite has always been considered a leader in developing and building the finest cables available. Do you have a cable problem? There's a good chance that Okonite engineers have already solved it. Find out today. The Okonite Co., Passaic, N.J.

4349

where there's electrical power . . . there's **OKONITE CABLE**

Twice As Much For The Same Price

In the cocktail lounge of the Mayflower Hotel we were all offering our words of wisdom relative to the electric utilities. I proposed my latest idea that we should quit emphasizing the decrease in average residential rates per kilowatthour. Even though this statistic has been very impressive, it has just about outlived its usefulness. Should the rate per kilowatthour continue to decrease, it will not drop significantly. At the same time, the total bill will be increasing substantially.

My friends at the Mayflower came to my rescue and pointed out that the Apr 14, 1958 commercial on "Studio One" used the same comparison. They talked about the total cost.

"You may not realize it, but electricity is one of your biggest bargains.

"Remember when electric refrigerators looked like this? 25 years ago, nine cents would run this machine a full day!

"Now, the same nine cents runs a much better refrigerator the same length of time, plus this laundromat, and vacuum cleaner and food mixer, roaster, fry-pan, iron and a TV set.

"Credit goes to electric light and power companies. You can use twice as much electricity as you did 25 years ago—for the same cost. If your bills look bigger, it's because you're using more than twice as much."

Fischer Black

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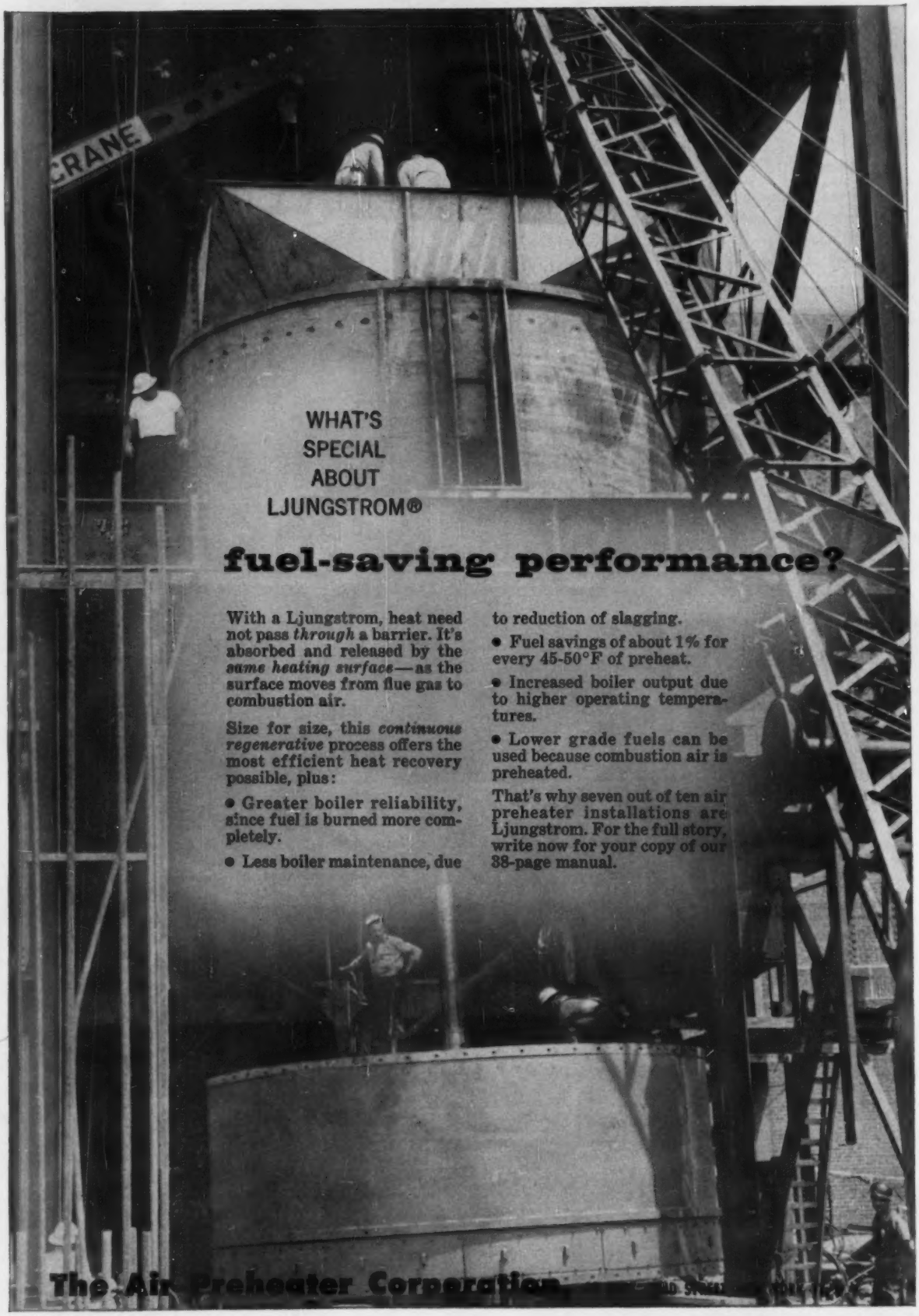
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SPECIAL
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LJUNGSTROM®
fuel-saving performance?
With a Ljungstrom, heat need not pass *through* a barrier. It's absorbed and released by the *same heating surface*—as the surface moves from flue gas to combustion air.
Size for size, this *continuous regenerative* process offers the most efficient heat recovery possible, plus:
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• Less boiler maintenance, due to reduction of slagging.
• Fuel savings of about 1% for every 45-50°F of preheat.
• Increased boiler output due to higher operating temperatures.
• Lower grade fuels can be used because combustion air is preheated.
That's why seven out of ten air preheater installations are Ljungstrom. For the full story, write now for your copy of our 38-page manual.
The Air Preheater Corporation

When you are asked to help out with a customer's lighting problem, you'll find us ready and willing to discuss with you the latest ideas, methods and information available from any one source,—Graybar!

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Every working day brings you questions from architects, electrical contractors, commercial establishments and industrials concerning the right lighting source and equipment to use for some particular installation. Always remember, you can supplement your own broad knowledge and experience through that of our Lighting Specialists,—men who have contributed to the planning of thousands of installations across the country. Graybar's roots are deep in the lighting industry, and ours is a mutual interest – better lighting for all.

Next time you have a knotty lighting problem, call your nearby Graybar office. Back up your dealers and contractors with the best of the current ideas selected from up-to-date developments of the nation's leading equipment manufacturers whom Graybar represents. You'll help build your load through the kind of lighting that will contribute to better production schedules in industry, greater sales for your merchant customers, and greater living enjoyment in homes in your area.

690

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GRAYBAR ELECTRIC COMPANY, INC., 420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK, IN OVER 130 PRINCIPAL CITIES

Allis-Chalmers—25 Years

new

3-Phase POWER Regulators

Save 33% space...
30% cost...20% weight!

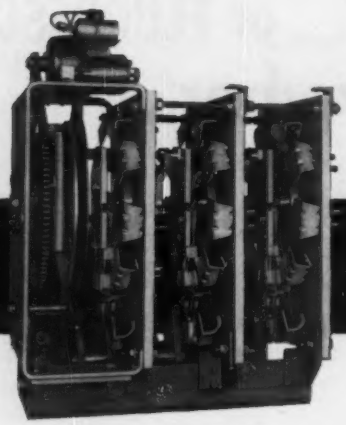
New design — new benefits to utilities are incorporated in the *NEW* Allis-Chalmers 3-phase power regulators.

- Now, substation space requirements for power regulators are reduced by at least one-third.
- Now, reduced sizes and weights for easier handling, lower installation cost.
- Now, cost per kva of 3-phase regulators is reduced 30%.
- Now, 600-amp maximum *Vari-Amp* rating is provided.

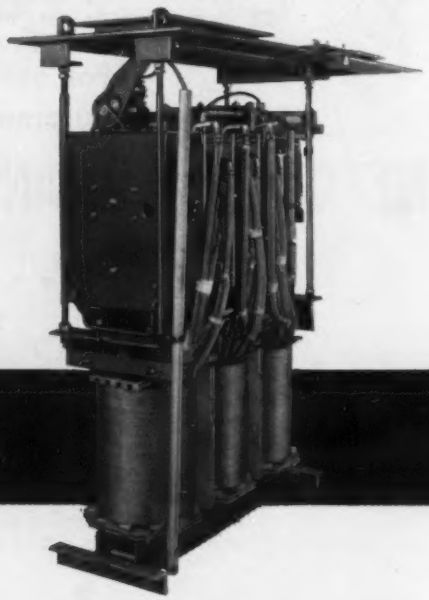
Available in most popular ratings

These new Allis-Chalmers power regulators are rated 500 and 750 kva, 8660 volts, and 500, 750 and 1000 kva, 13,200 volts.

These savings are so important it will pay you to re-evaluate your present substation planning on the basis of these new units. Check with your nearby A-C office or contact Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.



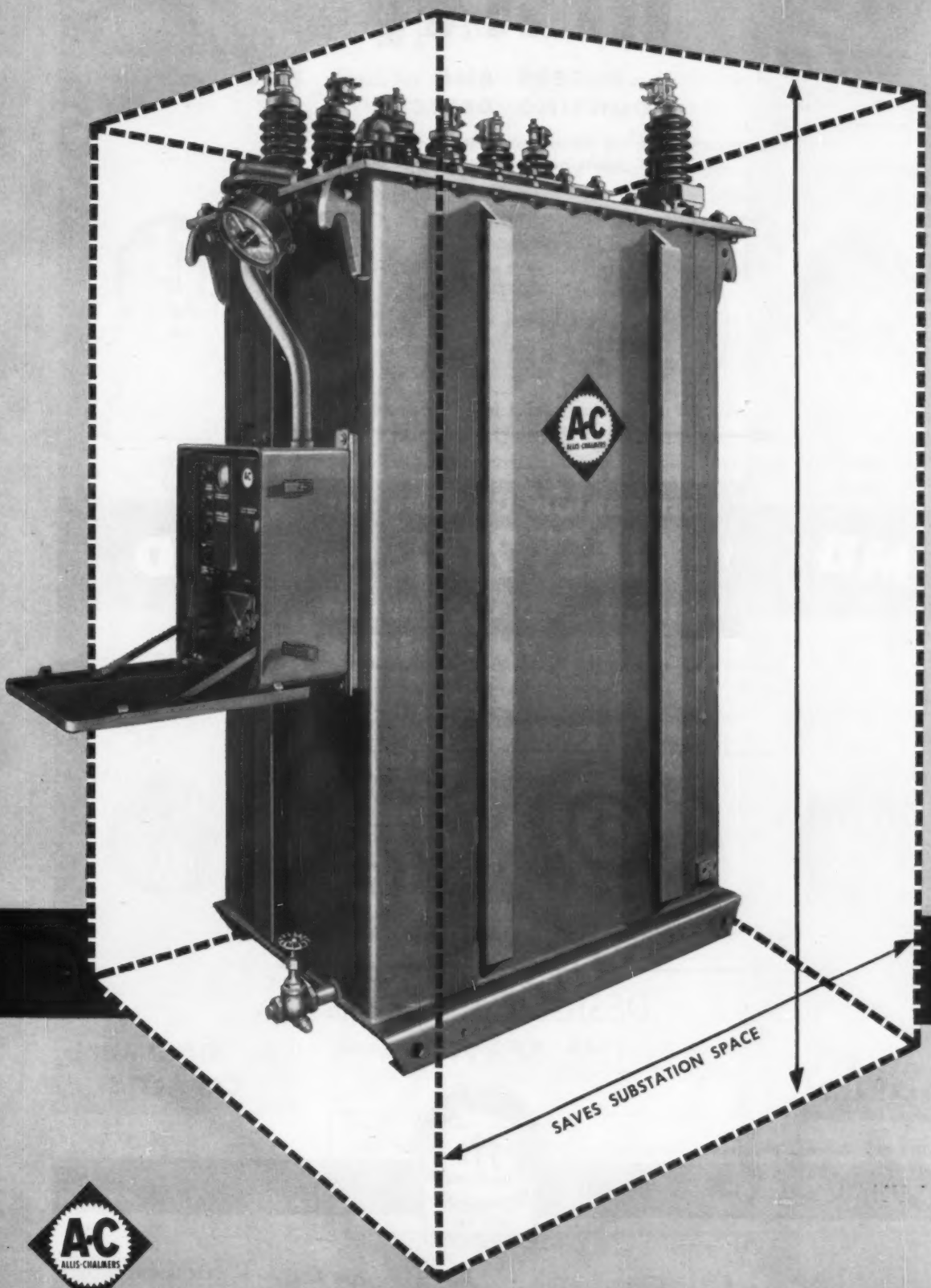
Heavy-duty tap-changing mechanism.



Unit construction combined with new space-saving arrangement of tap-changing mechanism.

ALLIS-CHALMERS

of Leadership in 5/8% Regulators



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CAPACITY! CONTINUED IMPROVEMENT!

DUNCAN

METERS AND MOUNTING DEVICES

—up to 200 amperes of service capacity using Self-Contained Extended Range Meters

TYPE MD

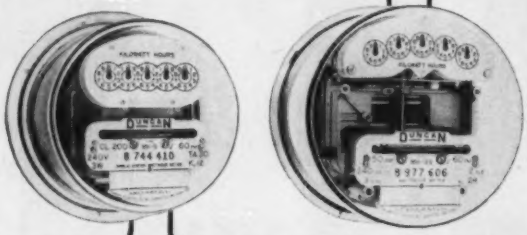
Now "High Capacity" with reinforced jaws. Particularly applicable for 200 amp. service on residential or other "Low Load Factor" Loads.

200A -MD-5

TYPE HD

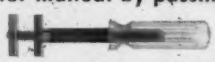
for "High Demand, High Load Factor" Loads.

200A -HD-5



MD Companion Devices for the **CLASS 200** meter —pioneered by Duncan **HD**

All HD and MD Devices have arrangements for manual by-passing.



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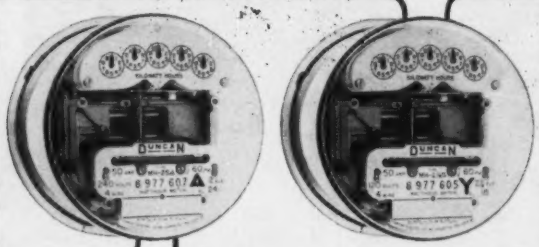

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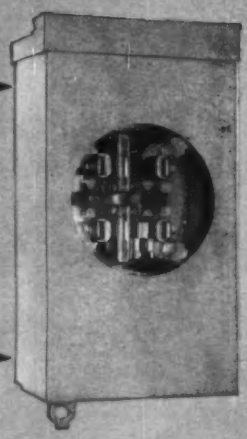


DESIGNED FOR THE SERVICE

for TOP ECONOMY

for MAXIMUM CAPACITY

DUNCAN ELECTRIC CO., INC. LAFAYETTE, INDIANA

LIVE BETTER ELECTRICALLY WITH FULL HOUSEPOWER

The Electrical Week

FUTURE NEWS ▶ **Watch for a stepped-up promotion of electric house heating** by utilities serving several large mid-western cities.

Look for battle on plutonium-producing atomic reactors. Key Democrats want AEC to build a gas-cooled reactor and two plutonium. Administration bill provides for a gas-cooled reactor and top officials insist plutonium reactors are not needed.

LATE NEWS ▶ **A "substantial" rate increase will be asked soon,** Pres Earle J. Machold, Niagara Mohawk Power, says . . . Quincy Electric Co asks Massachusetts Dept of Public Utilities for a rate hike of about 1.2¢ a day for the average household user . . . British Columbia Electric requests $6-million-a-year rate increase.

Carolina P&L and Carolina Aluminum win 50-yr FPC licenses for hydro projects on Yadkin-Pee Dee River. Action clears way for $40-million modernization-construction program by Carolina Aluminum..

Three proposed "partnership" A-power projects may have clear sailing at last. Joint Congressional Committee on Atomic Energy is raising no serious objections to Carolinas-Virginia Nuclear Power Associates; City of Piqua, Ohio; and Elk River Rural Co-op projects. AEC has already approved them.

Bill to up tax on poles from $2 to $5.50 each is introduced before Richmond (Va.) City Council . . . Public Service E&G and IBEW agree to 4.75% wage hike and fringe benefits . . . Washington Water Power stockholders approve merger with Spokane Natural Gas.

Electric revenues are up 4.7% in March over a year ago while net income registered a 7.2% rise for Class A & B electric utilities in U.S., reports FPC. Fuel costs were 4.6% under March, 1957.

Bill to ban cities from duplicating electric, gas, or water facilities already existing is passed by Kentucky legislature.

Sodium Reactor Experiment reaches design power level of 20 Mw of heat. SRE project was built and operated for AEC by North American Aviation; Southern Cal Ed provided conventional plant equipment.

Management changes . . . Vice Pres R. E. Doyle, Jr, succeeds retiring C. V. Sorenson as general manager of Indiana & Michigan Electric.

Due to the Memorial Day holiday, which necessitated an advanced press schedule, this week's power output chart has been omitted. Information will be included in next week's chart.

A TWO-MINUTE PREVIEW OF THIS ISSUE

EVENTS ▶ **Worldwide attention swings to Shippingport, Pa.,** where formal dedication ceremonies are held for the world's first atomic power station devoted solely to civilian use. The AEC-Duquesne Light project, now operating successfully for five months, is hailed by key figures such as President Eisenhower, Duquesne's Philip Fleger, Westinghouse's Mark Cresap, and Adm H. G. Rickover **(p 40).**

We're still way ahead of Russia, when it comes to power development. So asserts FPC Power Bureau Chief Francis Adams, who takes a close look at today's progress and tomorrow's prospects on **p 41.**

MANAGEMENT ▶ **By 1975 coal will furnish over 90% of total generation** of four regions of the U.S. Here's the 20-year fuel outlook for the four regions where coal already holds undisputed sway over utility fuel markets: the South Atlantic, Middle Atlantic, East South Central, and East North Central regions. Boiler-fuel price trends for these four regions are included in this report, the second in a three-part series **(p 83).**

MEETING ▶ **Utilities are lagging on research and must act now** in order to meet tomorrow's need for nuclear and thermal power, declared Pacific P&L's Paul McKee at a recent Northwest Electric Light & Power Assn meeting. Other timely topics, ranging from the advantages of flat demand rates to transformer design by computer, and sending-end reactors, were discussed by top industry officials at the Yakima meeting **(p 58).**

DISTRIBUTION ▶ **Chances are good that butt welds can be made at rate of 10 an hour** using a new process developed by Con Ed and a New Rochelle firm. The method for welding 14-in. steel pipe utilizes induced high frequency current, controlled pressure torsion and vibration **(p 50).**

Tree-trimming costs are chopped about $20,000 a year for Louisiana P&L's Northern Division, thanks to six pieces of mobile equipment and pneumatic tools. Operated by a trained ten-man team, the equipment consists of standard ladder trucks, two booms on 2-ton trucks, trimmers, a chipper, and pickup truck **(p 56).**

TRANSMISSION ▶ **A half million kva will soon be serving a new aluminum complex** now being built in the Ohio Valley by Ormet. The 465-Mva system, supplied by an extensive industrial substation, was designed for economical conversion and utilization, and high flexibility and reliability **(p 46).**

What methods best achieve correct sag and tension of large wires? Under which conditions should each of the three most common methods be used? In the article beginning on **p 52,** a B. C. Engineering Co project supervisor analyzes heavy wire sagging, pinpointing special problems and their solutions.

GENERATION ▶ **The unique cause of the explosion** at England's Uskmouth station has been explained by Central Electricity Authority. The accident, which wrecked a 60-Mw turbine generator and killed two men in the then recently commissioned power plant, all started when a never-before-encountered corrosion mechanism induced piston seizure into the unit's control system. Read this report on **p 49.**

SELLING ▶ **Even baby pigs are living better electrically.** The piglets, whether orphans or victims of undersized or oversized litters, can be saved from a runt's future with the Pigsaver. It automatically feeds warm sow's milk to eight pigs at once . . . With the new emphasis on selling, utility executives and their sales allies should find EEI's Directory of Training Materials useful **(p 70).**

INDUSTRIAL ▶ **An Ohio firm saves about $5,000 a year** since installing Diesel engine heaters in its trucks. The 2.5-kw units, which assure quick starts on cold mornings, have reduced maintenance charges and battery wear **(p 75).**

NEW EQUIPMENT ▶ **A network analyzer that grows with your needs** has been introduced. Based on the building block principle, it can expand from a basic unit of 3 generators and 24 circuit elements to any combination up to 21 generators and 400 elements **(p 76).**

One center bolt parallel groove connectors that can be worked hot by vise grip pliers are available . . . Now ready to meet your peaking and reserve generation needs: a 6-Mw transportable plant with three 2-Mw diesel units, one control unit . . . Aluminum sheath cables with 1,000 Mcm single and No. 4/0 conductors have rubber insulation **(p 76).**

MANUFACTURERS ▶ **Production wheels have started spinning** at a huge aluminum reduction plant in Ohio. The $110-million Ormet facility will put out 180,000 tons of primary aluminum annually when it goes into full scale operation later this year **(p 66).**

Commonwealth Ed will soon be able to remove fly ash from stack gases at over 600 lb per min with a new electrostatic precipitator . . . Paper-wound condenser bushings, veterans of 45 years service at Metropolitan Ed, still meet modern test standards **(p 66).**

PEOPLE ▶ **A man who rose to utility president without "pet peeves or ulcers"** has been named to head Mississippi Power. He's A. J. Watson, Jr, who sees his new job as a "challenging assignment" **(p 89).**

Robert K. Zimmerman becomes a vice president at Kansas City P&L . . . Florida P&L elevates J. H. Keele to vice president of sales promotion activities **(p 89).**

The utility industry's place in our system of government is the thesis of a new book entitled, **"Public Utilities in American Capitalism".** Economic and legal principles underlying public utilities are presented. The author, a professor of economics, treats his subject mainly from an historical viewpoint. The text assumes very little prior knowledge of the utility industry (which includes gas, communications, and transportation in addition to electric companies). The text is divided into three parts: Economic and institutional foundations, administration aspects, and planning and coordination. Under the latter section the author discusses the development of public and cooperative ownership.— **Public Utilities in American Capitalism. By M. G. Glaeser. Published by Macmillan Co, 60 Fifth Ave., New York 11, N. Y. 617 pages. Illustrated. Price $7.50.**

TECHNICAL NOTES

Maleic hydrazide and the polychlorinated benzoics have greatly reduced tree growth when bands of these chemicals have been painted on the trunks or branches of trees or when the chemicals have been sprayed on the foliage.

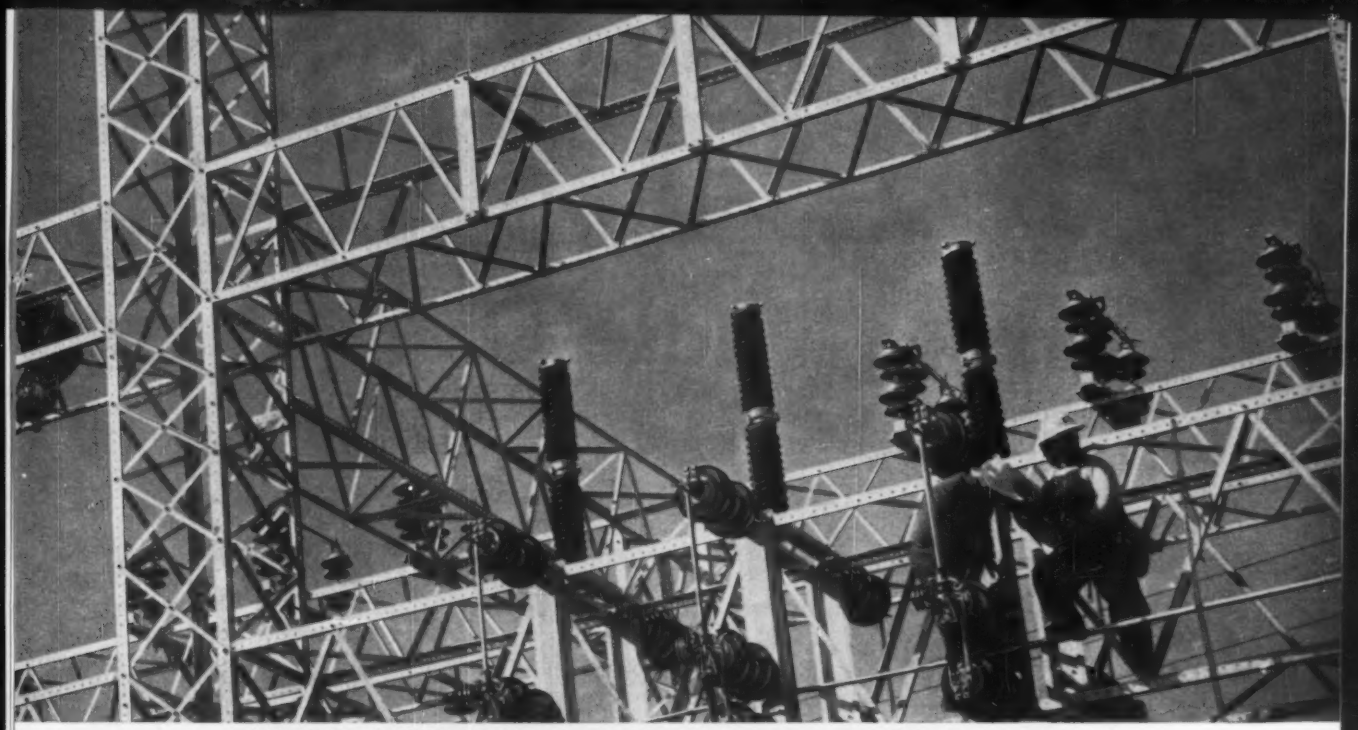
Dysprosium, a rare earth, may be useful in the atomic age. It has an exceptional ability to absorb neutrons and a melting point of 1,400C. These characteristics suggest its use in nuclear reactor control rods.

"Sun-spot" activity is thought to cause false operation of ground relays on transmission lines by producing a residual current which flows from one area to another through grounded-wye transformer banks.

Dual purpose reactors probably cannot operate with high load factors. For in reactors producing military plutonium it is necessary to remove the fuel after relatively low irradiation periods to avoid production of unwanted isotopes of plutonium.

FROM EDITORS IN THE FIELD

Steel walls attenuate transformer noise sufficiently for locations where moderate attenuation is adequate at lower installed cost than masonry, according to Detroit Edison engineers. Additional savings are seen in its 50% salvage value and the ability to move it to another site for 40% of original installed cost. Other favorable applications are its ability to deflect noise from a critical direction and correct the extremely irregular sound contour of some transformers.



THREE-PHASE INSTALLATION of L-M's new Ultra-Valve arresters, rated 60 kv maximum, in a 69 kv substation. The arresters are light and compact, and have outstanding electrical characteristics.

With Simple Series Gap and Valve Disc Design,

New Ultra-Valve Intermediate-Class Arrester Is Exceptionally Rugged, Durable, Light, Compact

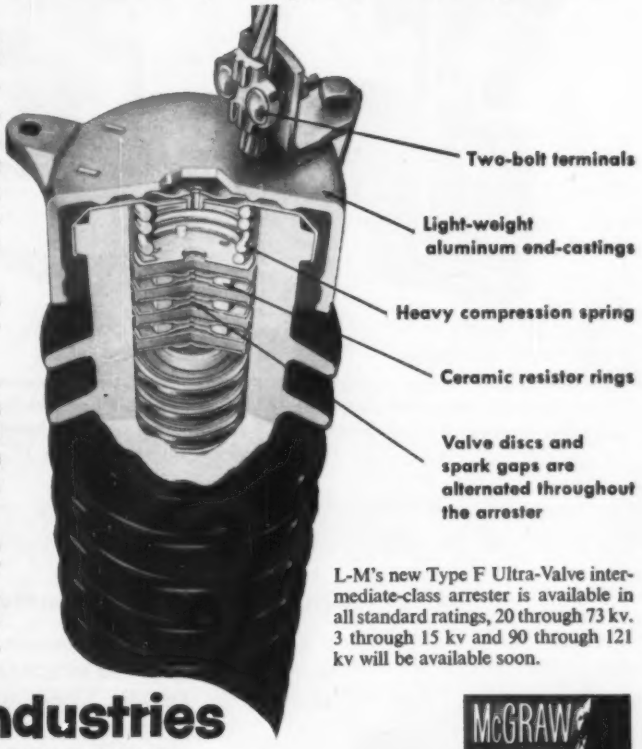
Line Material engineers have developed a new, light, compact intermediate-class arrester that features rugged simplicity, exceptional durability and excellent protection.

These new Ultra-Valve arresters are easy to handle from receiving dock to job site, because they are decidedly lighter and more compact. Reduction in height has been achieved without a corresponding sacrifice in desirable external creepage distance, by providing a number of relatively deep skirts on the external housing surface.

The unusually rugged, simple construction minimizes the possibility of concealed damage caused by inadvertent rough handling in shipment or installation.

L-M's new Ultra-Valve arresters are capable of meeting the minimum discharge capacity and duty cycle tests for station-type arresters, as listed in ASA Standard C62.1-1957. These arresters provide excellent protective characteristics and are presently available in standard voltage ratings from 20 kv to 73 kv inclusive.

Ask your L-M Field Engineer for more information on how L-M's new Type F arrester can provide greater lightning and switching surge protection on your system. Or write Line Material Industries, Milwaukee 1, Wis. In Canada, Canadian Line Materials, Ltd., Toronto 13, Ontario.


Two-bolt terminals
Light-weight aluminum end-castings
Heavy compression spring
Ceramic resistor rings
Valve discs and spark gaps are alternated throughout the arrester

L-M's new Type F Ultra-Valve intermediate-class arrester is available in all standard ratings, 20 through 73 kv. 3 through 15 kv and 90 through 121 kv will be available soon.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

Lightning Arresters

McGRAW EDISON

329

Only L-M Offers Complete Line of Low-Cost, Heavy-Duty Three-Phase Oil Switches

Now all types of loads—capacitive or inductive—can be switched economically with manual or remote operation, using one of the Kyle "V" family of three-phase oil switches.

Three Types of Switches

L-M's Kyle "V" family consists of three basic types of switches:

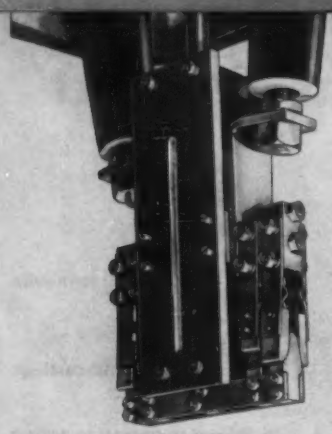
1. One for general-purpose switching, such as single-step capacitor switching and automatic transfer of normal power-factor loads.

2. One for automatic transfer and tie schemes involving loads having low lagging power-factor currents, such as unloaded motors.

3. One designed specifically to withstand the severe duty imposed by step-switching capacitors.

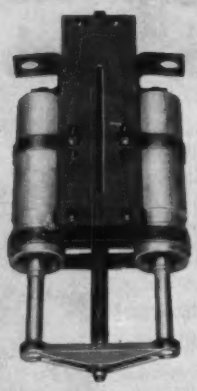
These switches have a maximum design voltage of 15.5 kv, a momentary rating and latching rating of 20,000 amperes (asymmetric), and a four-second rating of 6,000 amperes (symmetric).

All three switches are available with motor-driven actuator assembly for remote electrical operation. The general-duty (1) and inductive-current (2) switches are also available for hook stick operation, or with remote manual linkage for operation from base of pole.



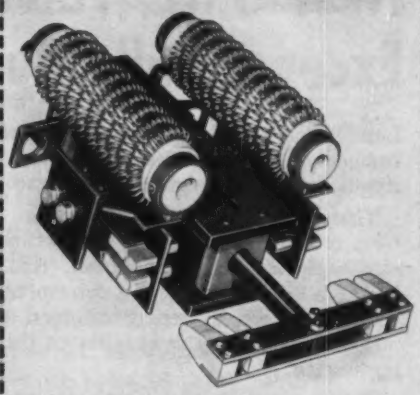
GENERAL DUTY CONTACT ASSEMBLY

Copper-tungsten arcing contacts absorb the punishment of switching, keeping erosion on load contacts at a minimum.



INDUCTIVE CURRENT CONTACT ASSEMBLY

Interrupting tubes assure minimum arcing time during load-current interruption, thus enabling the switch to handle currents with power factor as low as 10% lagging.



STEP CAPACITOR CONTACT ASSEMBLY

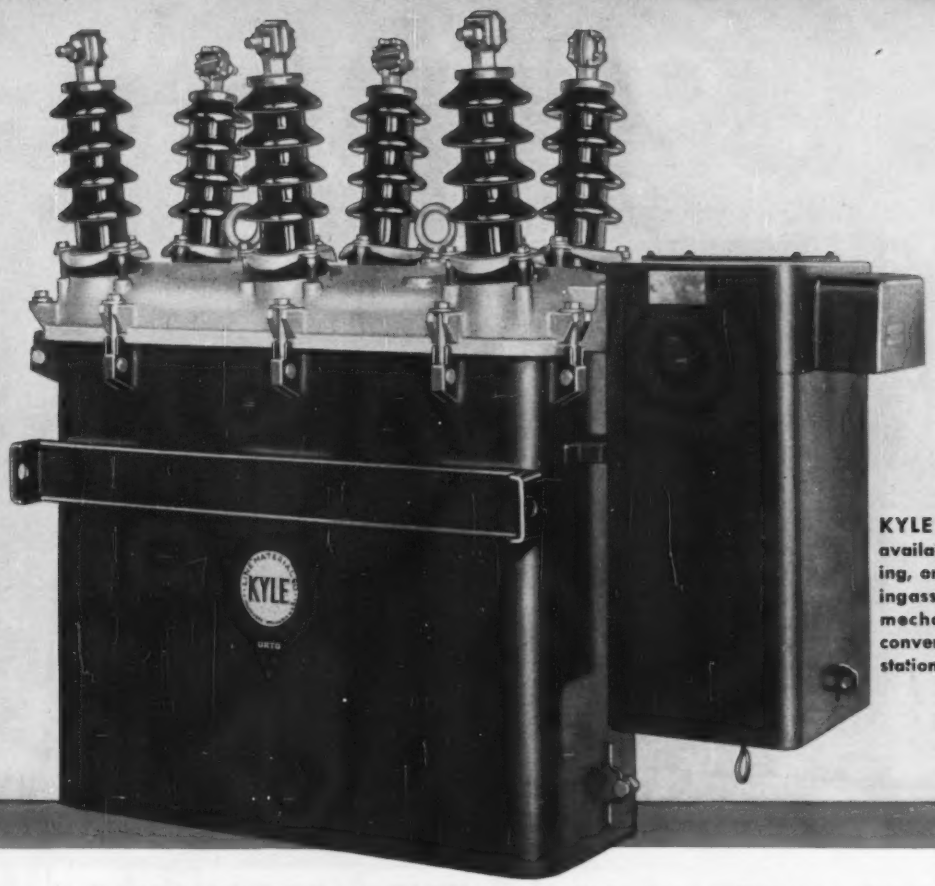
7½ ohms of resistance in series with arcing contacts limits the high-frequency transient inrush to values within the short-time capability of the switch.

Get More Complete Information

L-M offers the most complete line of oil switches and accessories for manual and automatic load transfer and switching schemes. Ask your L-M Field Engineer for information and bulletins. Or write Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY



KYLE "V" SWITCHES are available for crossarm mounting, or with substation mountingassembly,includinghoisting mechanism, to provide for convenient and versatile substation installation.

KYLE® Heavy-Duty, Three-Phase Oil Switches 400 Amp. 110 kv BIL

2.4 kv through 14.4 kv • Maximum design voltage 15.5 kv • Momentary rating 20,000 amps (asymmetric) • Four-second rating 6,000 amps (symmetric)

	SWITCHING RATINGS	TYPES	PRICE	APPLICATIONS
General Duty Switch	**7.2 kv through 14.4 kv** 75-100% p.f. 200 amps rms 40-75 % p.f. 100 amps rms 10-50 % p.f. 50 amps rms **2.4 kv through 7.2 kv** 75-100% p.f. 400 amps rms 50-75 % p.f. 200 amps rms 10-50 % p.f. 100 amps rms	**Hook Stick Operation**	**VH $625**	Manual sectionalizing switches.
		Remote Electrical Operation	**VR $885**	Automatic transfer schemes for duplicate service, feeder switching, bus transfer switching, bus ties. Single-step capacitor switching.
		Remote Manual Operation	**VM $710**	
Inductive Current Switch	Switches are capable of switching their full continuous rating, 400 amps from unity power-factor down to 10% lagging power-factor.	**Hook Stick Operation**	**VLH $655**	Automatic transfer and tie schemes involving low lagging power-factor currents.
		Remote Electrical Operation	**VLR $915**	
		Remote Manual Operation	**VLM $740**	
Step Capacitor Switch	Nominal capacitor switching current 300 amperes	**Remote Electrical Operation**	**VCR $1055**	Designed specifically to withstand the severe duty imposed by multi-step switching of capacitor banks.

The Kyle Type VR, VLR and VCR switches are equipped with motor-operated actuator mechanisms to make possible remote electrical operation. Such remote operation can be initiated either by push button or through current, voltage, time-sensitive, or other relay scheme.

ACCESSORIES

Available on VR, VLR, and VCR.

A 1, 2, 3, or 4-stage auxiliary switch can be factory installed for use when the VR switch is used with relay or interlocking schemes or switchboard position indication.

Low-voltage arresters can be installed within the actuator housing.

Heating element can be installed in the actuator housing when application is in unusually damp, foggy, or humid atmospheres.

15" and 17" creepage distance bushings are available for the entire family of switches.

Kyle® Oil Switches

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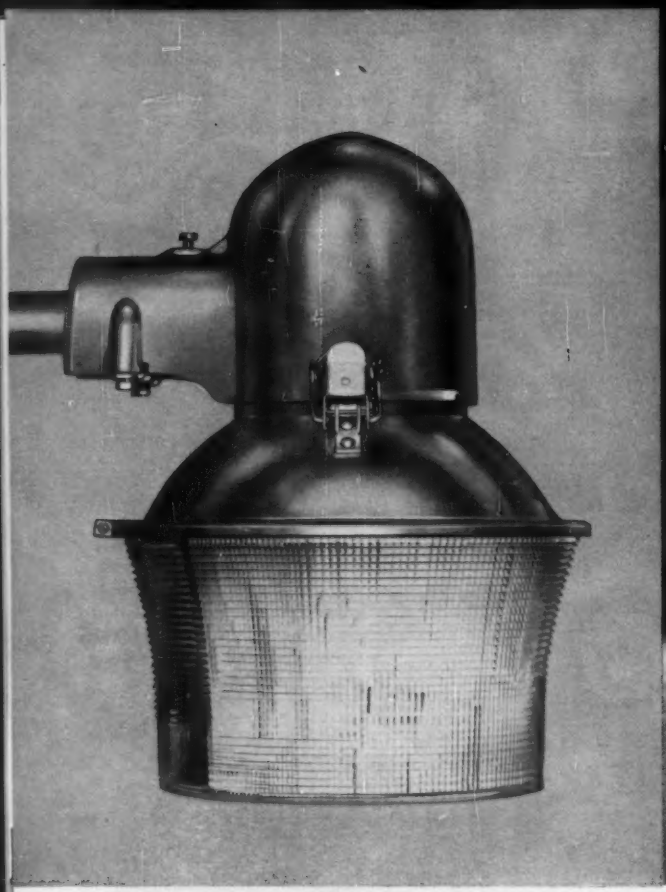
McGRAW EDISON



L-M'S OPEN TYPE SUBURBANAIRE unit provides highly efficient lighting, with choice of mercury vapor or incandescent lamps, scientifically designed optical system, and low original cost and simple maintenance. Also available with photoelectric control.

ONE OF THE L-M SUBURBANAIRES that light the 24 blocks of Mulholland's beautiful new Oakdale Subdivision, Oak Lawn, Ill. Multiple service is all underground. Knott & Mielly, Chicago, were the electrical contractors in this highly attractive, efficient installation that helps makes the homes in this subdivision more salable.

Subdivider Chooses L-M Suburbanaire To Light New Oak Lawn, Ill., Development

To provide modern, efficient lighting with economical maintenance, Clem B. Mulholland, Inc., selected the L-M Suburbanaire unit to light its new Oakdale subdivision in Oak Lawn, Ill. Knott & Mielly, Chicago electrical contractors, made the installation.

Helps Sell Homes

The L-M units were selected, and the lighting system was planned, to provide safety and added nighttime beauty. The street lighting was a strong selling feature. That this is effective is indicated by the fact that in a neighboring subdivision that is similar but not lighted, homes do not sell nearly so well as in Mulholland's well-lighted Oakdale subdivision.

Luminaires are mounted on 8-foot upsweep brackets on 25-foot metal poles. Service is multiple, on six photoelectrically controlled circuits. All wiring is underground. Normal spacing of the lights is 300 feet, which provides a luminaire at each corner and in the center of the block.

The whole lighting program has been most gratifying to the subdivider, and the residents who have purchased Oakdale homes, and to Village Manager Camille Andre and other officials of the Village of Oak Lawn, who heartily approve the choice of lighting.

Get Complete Information

Many subdividers have had similar experiences with the use of lighting as a selling feature. L-M offers a full line of luminaires of all types—incandescent, mercury vapor, and fluorescent—for rural, neighborhood, shopping center and highway lighting, together with application engineering service. Call the nearest L-M office for a lighting engineer; or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada, Canadian Line Materials, Toronto 13, Ontario.

McGRAW EDISON

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LINE MATERIAL Industries Outdoor Lighting

McGRAW-EDISON COMPANY

AT IOWA FALLS, L-M "Flying Farmer" lighting was installed in two days by volunteer help of the flyers using the airport. Cost was partly paid for by the Iowa Aeronautics Commission. Complete equipment for a 2,000-foot runway such as this one costs only $665.

What Flyers Say About Iowa Falls

Goes For All Of Iowa's "Flying Farmer"-Lighted Airports

"He was ready to push the 'panic button' when he saw the lighted runway . . ." An Iowa airport director tells of an Iowa pilot lost at night during a storm, almost out of fuel, and desperate, who was saved by a $665 string of runway lights at a municipal airport. This is only one of many successful landings by pilots lost at night or having mechanical trouble.

The Iowa Commission's state-aid program has resulted in increased night flying, more business flying, greater plane utilization, and good will for the towns with these all-night-lighted runways.

Iowa Falls is one of 30 Iowa cities with L-M "Flying Farmer" runway lights. Here is what some Iowa businessmen say about it. *John L. Butler*, Eldora lawyer: "The runway lighting at Iowa Falls and other airports, including Eldora, gives a feeling of security and adds to the utility of the plane." *Paul I. Barker*, insurance agent and secretary of Scenic City Flying Club: ". . . very reassuring after dark . . . a fine ad for our town."

Jim Young, Iowa Falls district supervisor for Iowa Electric Light & Power Company: "Gives me a longer day and a much safer one . . . Line Material's small field packet is a very adequate lighting scheme. The cost with the commission's help was well within our reach."

"Flying Farmer" kits were developed for small airports and taxiways of larger ports by Line Material, pioneer designer of airport runway lighting equipment, including high-intensity controllable beam lighting used at most of the largest airports in the country. Mail the coupon for article on Iowa plan by Frank Berlin, Director, Iowa Airport Commission and folder on the "Flying Farmer" kits. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

"Flying Farmer" Kit Only 33¢ Per Foot!

You can have a "Flying Farmer" kit for a 2,000-foot runway for only $665. This includes 18 clear lights for runway, 12 green threshold lights, yellow cones, lamps, stakes, 10,000 feet of wire, 30-amp switch. Only 33¼¢ per runway foot—amazing value! Also 2,500-foot runways at $775; 3,000-foot, $885. For runways, landing strips, taxiways; greatly increase the use of your plane and your airport. Mail coupon for information and order blank.

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LINE MATERIAL Industries

McGRAW-EDISON COMPANY

LM Airport Lighting McGRAW EDISON

MAIL THIS COUPON TODAY

LINE MATERIAL INDUSTRIES, Milwaukee 1, Wisconsin FL78

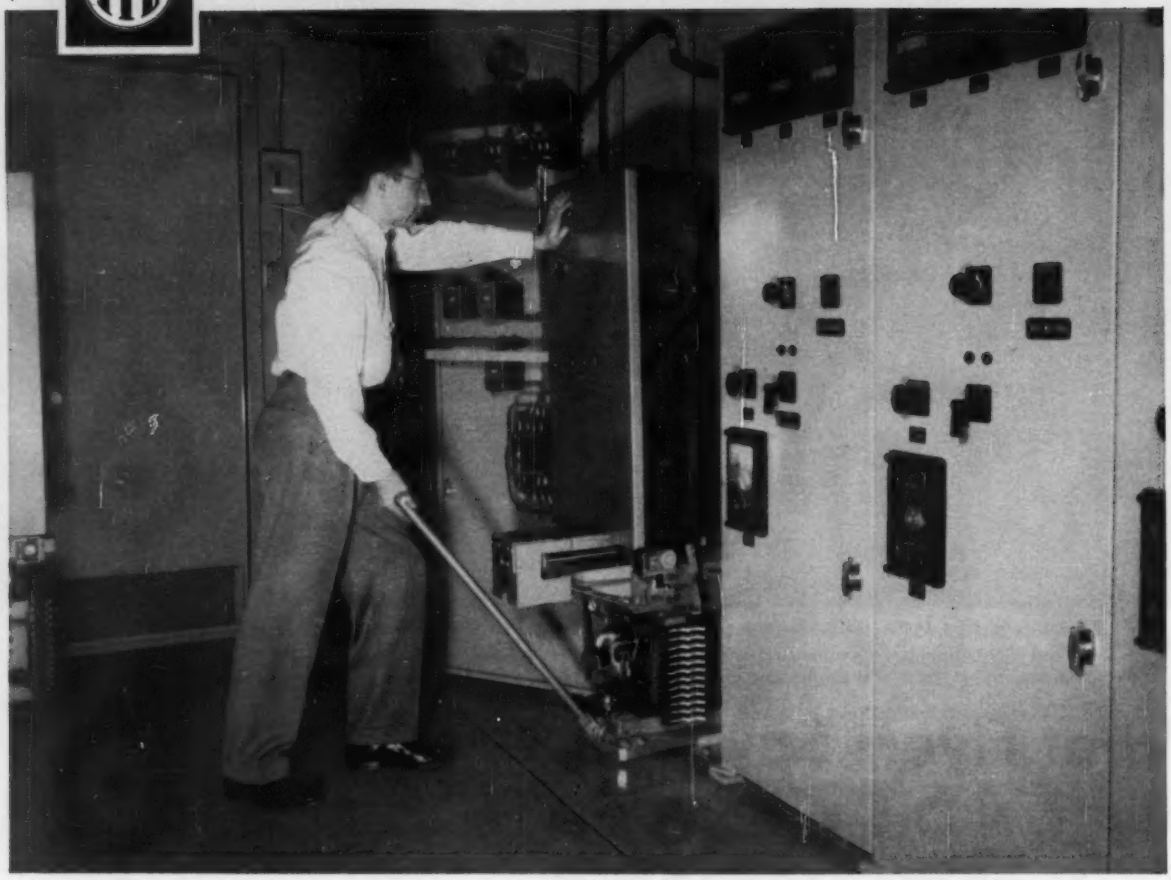
Please send free, copy of the Iowa plan article, a "Flying Farmer" folder, and order blank. SK58 FF78

*Name*_____

*Business*_____

*Address*_____

*City*_____ *State*_____



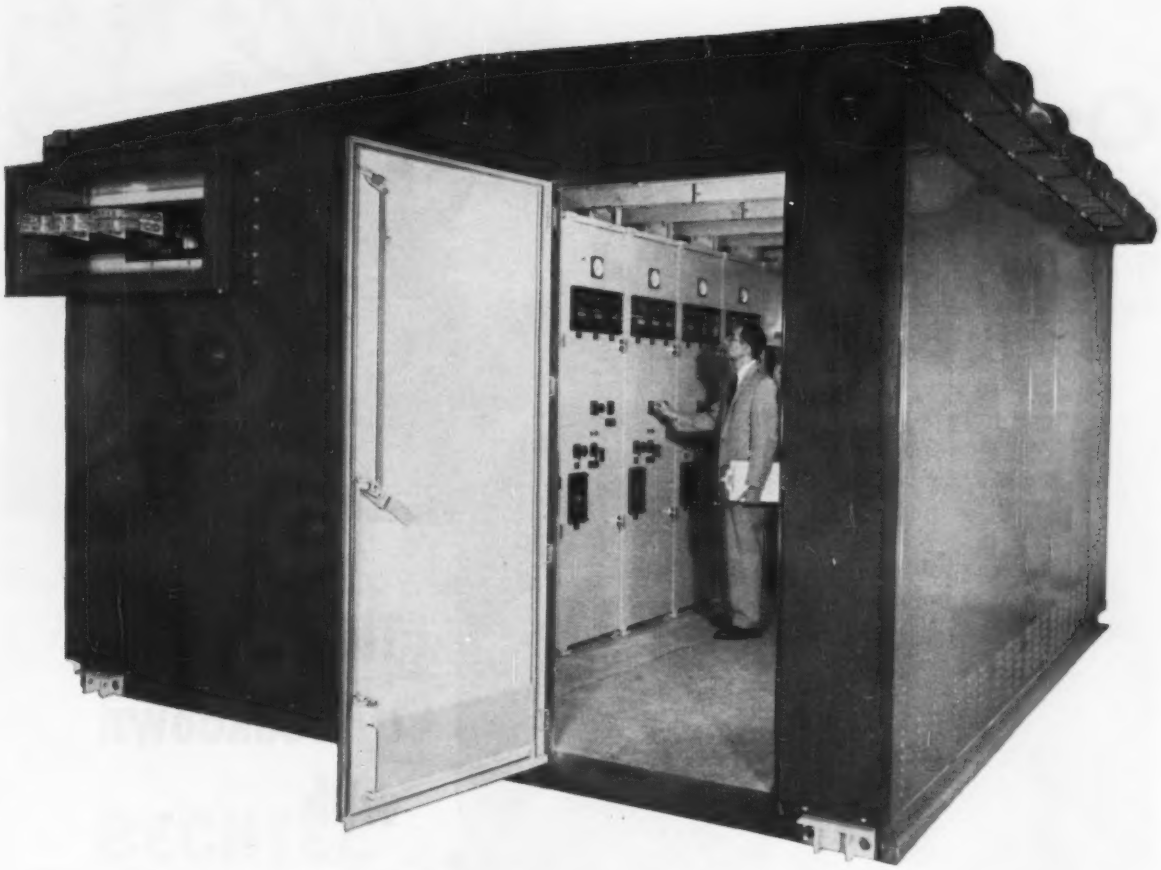
Walk-In Outdoor Shelters Now Being Installed

Hinged rear doors afford easy access to rear of switchgear.

Now available are I-T-E Walk-In Shelters for housing metal-clad switchgear in outdoor locations. These are being produced to meet a growing demand, and already two installations of this I-T-E development are in progress. They render the big service of permitting personnel to maintain switchgear in defiance of weather. These I-T-E Walk-In Shelters feature all the following advantages:

- **Completely gasketed doors, side sheets and frames. Doors are sealed with cellular neoprene sponge; side sheets and frames are sealed with wool felt, impregnated with chromite.**

- **All parts are treated for rust resistance, painted and baked prior to assembly. This protects the metal against rust and corrosion. Further, the bottom of the entire unit is undercoated.**



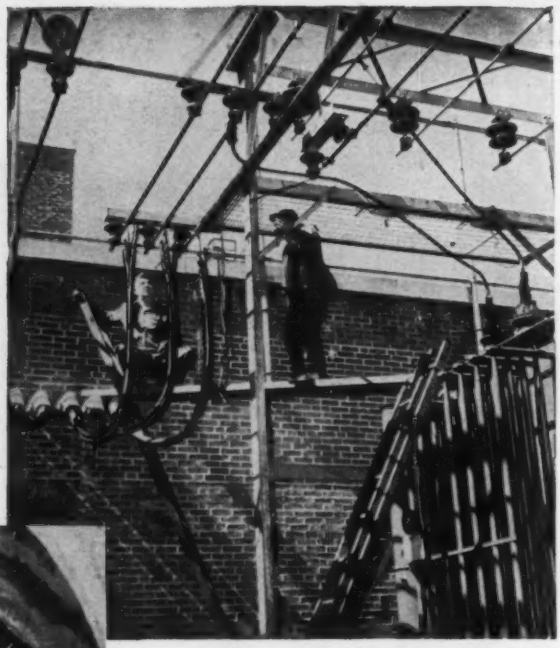
to Protect Service Personnel Against Weather

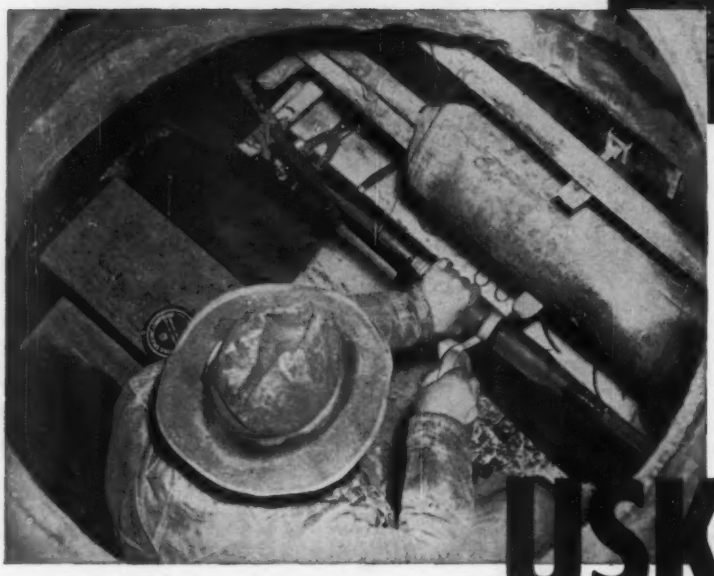
- **The shelter is completely self-sustaining. It is equipped with ventilating louvers, lights, heating units and convenience outlets.**
- **The entire structure is strong enough to be pier mounted, if desired, with resulting increased savings.**
- **Hinged rear doors afford easy access to rear of switchgear.**
- **Transformer connections can be made through weatherproofed throats, roof bushings, or underground cable, as required.**
- **Space is provided for storing grounding devices or spare circuit breakers.**
- **Nonskid flooring insures safe footing for operating personnel.**
- **Standard shelters are available for any size switchgear assembly.**

For complete information about I-T-E Walk-In Shelters for switchgear, contact your nearest I-T-E sales office or write Switchgear Division, I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ont.

I-T-E CIRCUIT BREAKER COMPANY
PHILADELPHIA, PENNSYLVANIA

Overhead or Underground





There's never a breakdown with USKORONA tape

On splicing or terminating electrical cables on underground power lines, street lighting circuits and transformer leads, on secondary network systems—to name just a few—Uskorona tape is *essential* because it is the only tape that is resistant to both ozone and moisture. It fuses with and becomes a part of the insulation and gives the same dielectric strength as the original insulation. Naturally, it exceeds A.S.T.M. specifications.

Uskorona® was developed to assure ozone and moisture protection to high voltage lines. Here's how good Uskorona is:

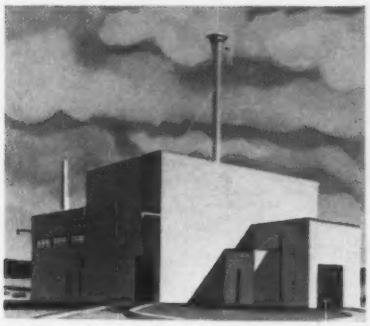
- In a corona-(ozone) resistance test of 4 leading brands, Uskorona was the only tape still intact after 4 hours of exposure.
- Even after 1500 additional hours of continuous exposure, Uskorona remained as fresh and corona-resistant as at the start.

Obtainable at any of our numerous distributors, any of the 28 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

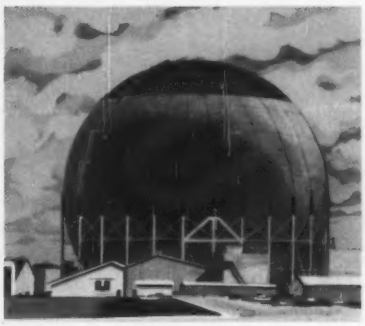
Mechanical Goods Division

United States Rubber

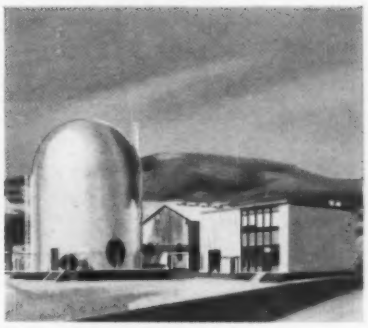
4 Firsts in Nuclear Power



FIRST nuclear electric power generation: Experimental Breeder Reactor I, National Reactor Testing Station, Idaho. Constructed, 1951, for Atomic Energy Commission.



FIRST nuclear electric power for commercial use: Knolls Atomic Power Laboratory, West Milton, N. Y., operated by General Electric Company for the AEC. Nuclear reactor by G-E — power plant engineered and constructed by Bechtel, 1955.

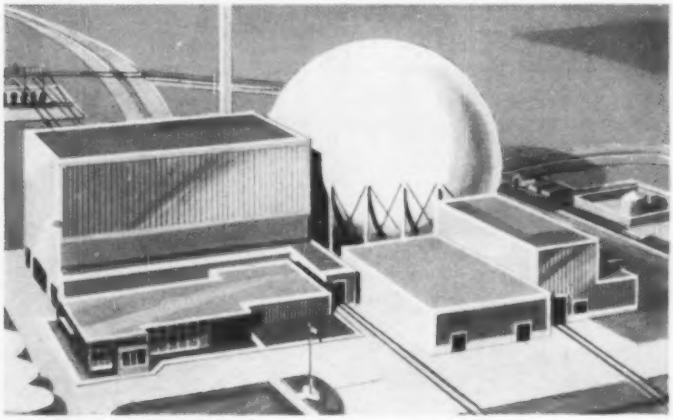


FIRST all-privately financed nuclear power plant: Developmental boiling water reactor at General Electric's Vallecitos Atomic Laboratory, Pleasanton, California, furnishes steam for electric generating facilities of the Pacific Gas & Electric Company. Engineered and constructed in 1957 for G-E and P G & E.

BECHTEL
Corporation

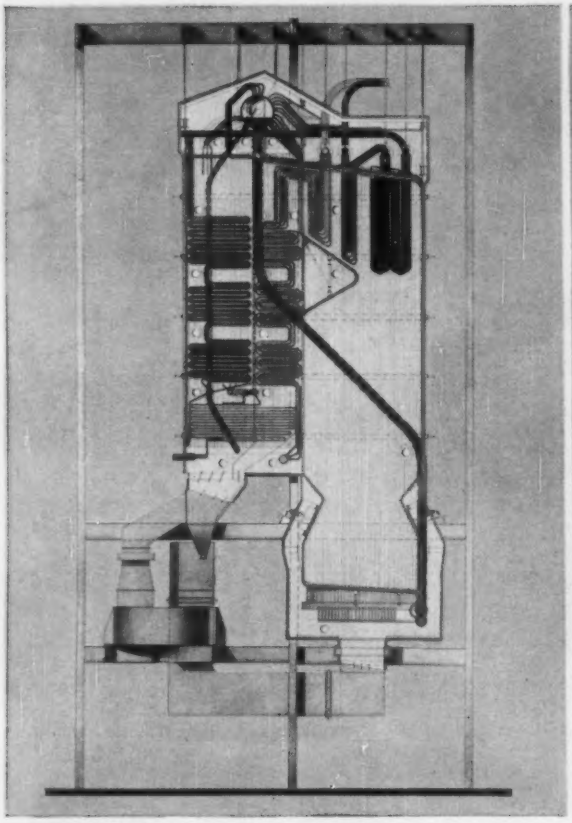
Engineers and Builders for Industry

In each of four projects recognized as important "firsts" in the development of nuclear power for peacetime uses, Bechtel has had an active and substantial part.

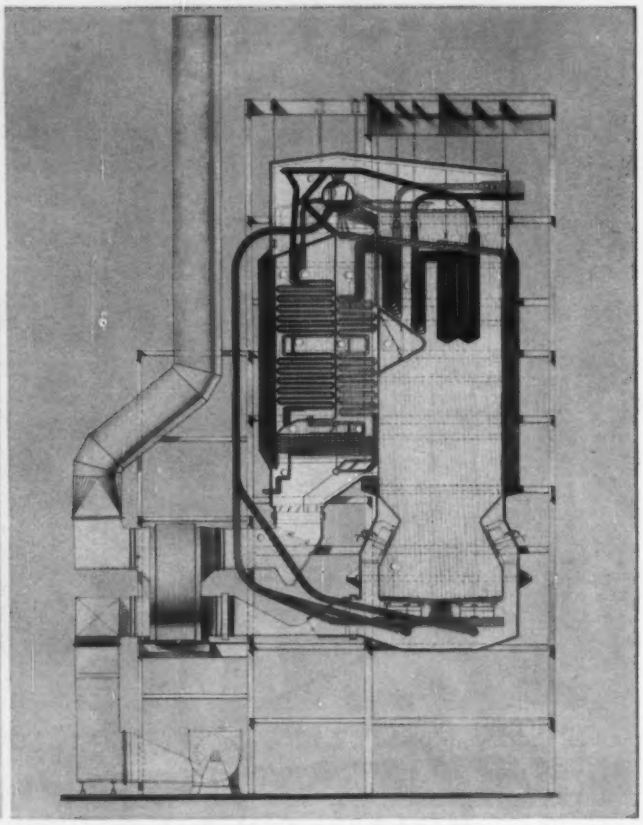


FIRST major—and America's largest—privately financed all-nuclear power plant: the 180 megawatt Dresden Nuclear Power Station of Commonwealth Edison Company, Chicago, and the Nuclear Power Group, Inc. Bechtel, a member of the Nuclear Power Group, is engineer-constructor for General Electric, the prime contractor. Now under construction.

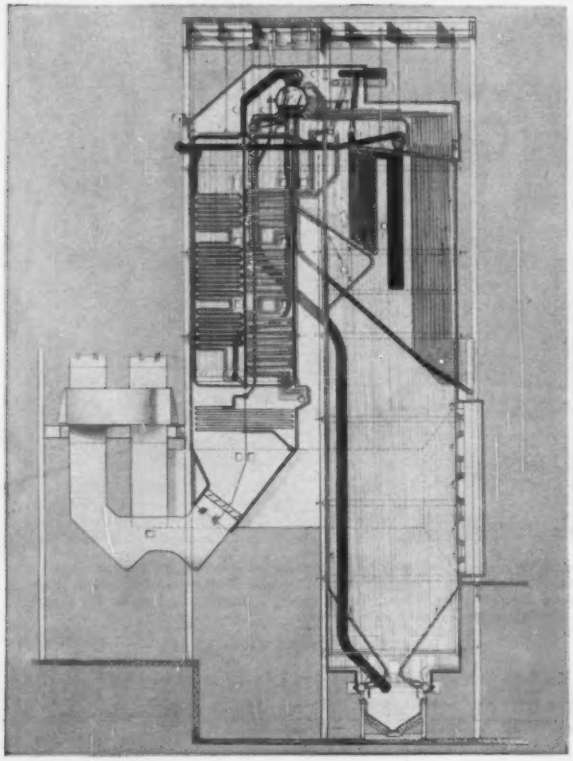
SAN FRANCISCO — Los Angeles — New York — Houston • **CANADIAN BECHTEL LIMITED:** Toronto — Vancouver

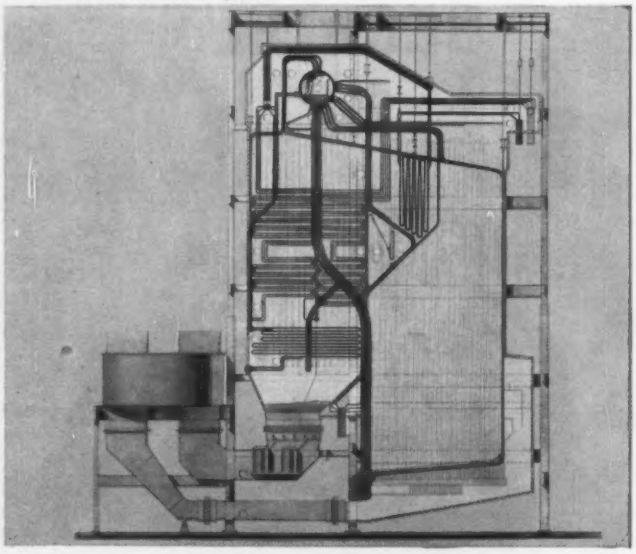


TURBO FURNACE Reheat Unit for **Florida Power Corporation** has capacity of 600,000 lbs/hr. 1750 Psi, 1000/1000 F. Fuels: oil, gas. Could convert to coal with minimum outage. **Black & Veatch.**



This Riley **TURBO FURNACE** Reheat Steam Generator for **Dallas Power & Light Company** is pressurized, has a steam capacity of 1,200,000 lbs/hr. 1005/1005 F. 2125 Psi. Will burn gas and oil initially and convert readily to lignite, coal in future. **Ebasco Services, Inc.**





This 350,000 lbs/hr. Gas Fired Reheat Unit is operating at **Central Louisiana Electric Company's** Teche Power Station. A duplicate is being installed at Coughlin Station. 1650 Psi, 1005/1005 F. Fired by Riley Intertube Burners. **Sargent & Lundy.**

This 690,000 lb/hr. Reheat Unit is now on the line at R. S. Wallace Station of **Central Illinois Light Company** 1650 Psig 1000/1000 F. Fuel: Central Illinois coal. **Commonwealth Associates, Inc.**

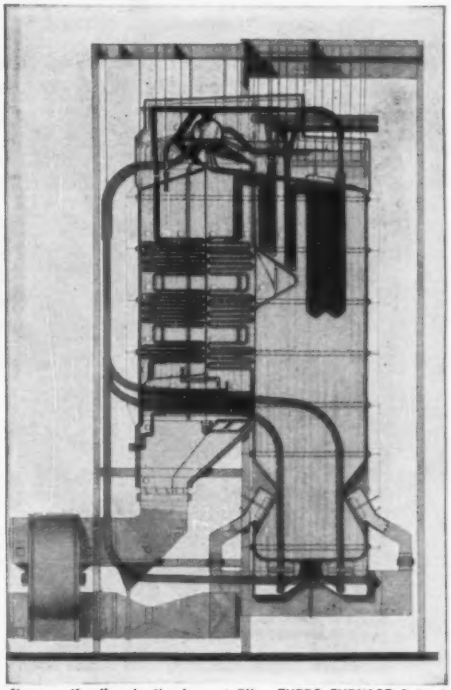
RILEY

A LEADER IN THE DESIGN, MANUFACTURE AND ERECTION OF PUBLIC UTILITY CENTRAL STATION STEAM GENERATING UNITS

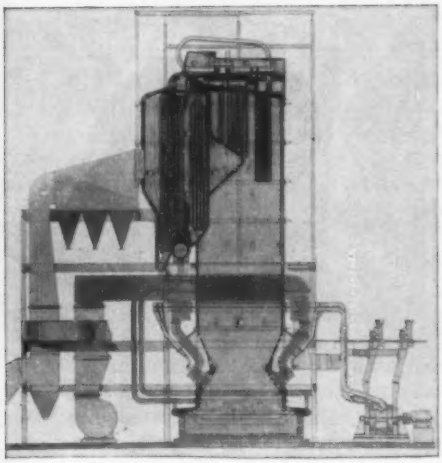
RILEY STEAM GENERATING UNITS HAVE PRODUCED AN OUTSTANDING RECORD FOR DEPENDABILITY AND EFFICIENCY

Over the years Riley Boilers have produced an outstanding record of performance for their users. This record has in turn supplied Riley a large reserve of satisfied customers who consistently install Riley boilers as their production facilities expand. Today, Riley is considered one of the foremost suppliers of steam generating equipment in the world. Riley boiler designs cover every steam capacity and pressure required for modern industrial power plants and public utility installations. A complete Riley Steam Generating Unit includes boiler, superheater, reheater, economizer, air heater, waterwalls and steel clad or pressurized setting. With fuel burning equipment selected from Riley's wide range of fuel burning products users are able to purchase complete steam generating units fabricated, erected and serviced under a single contract without divided responsibility. Whatever your steam and fuel burning requirements may be, you can rely on Riley to provide a highly efficient unit that will assure satisfactory and dependable service for many years.

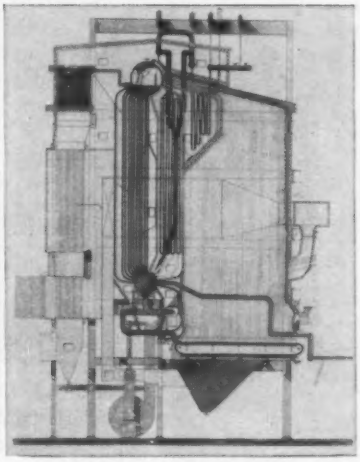
RILEY STOKER CORPORATION
WORCESTER, MASSACHUSETTS



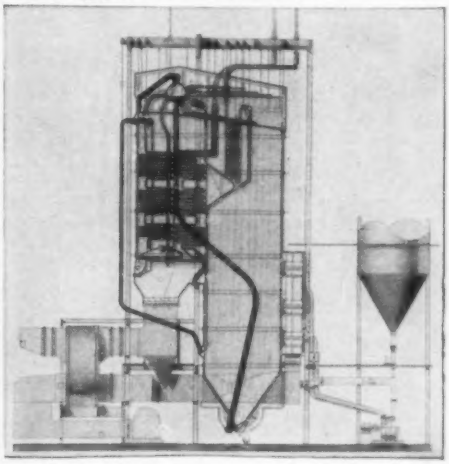
Now **on the line** is the largest Riley TURBO FURNACE Reheat Unit — The 1,550,000 lbs/hr unit at Sterlington Steam Electric Station, **Louisiana Power & Light Company**; designed for gas, oil; fluid coke, coal, lignite in future. **Ebasco Services, Inc.** A 1,650,000 lbs/hr unit designed for coal will be installed at Little Gypsy Steam Electric Station.



Three 500,000 lbs/hr. TURBO FURNACE Boilers are successfully firing Fluid Coke for **Delaware Power & Light Co.** at Tidewater Oil Company's Flying "A" Refinery.



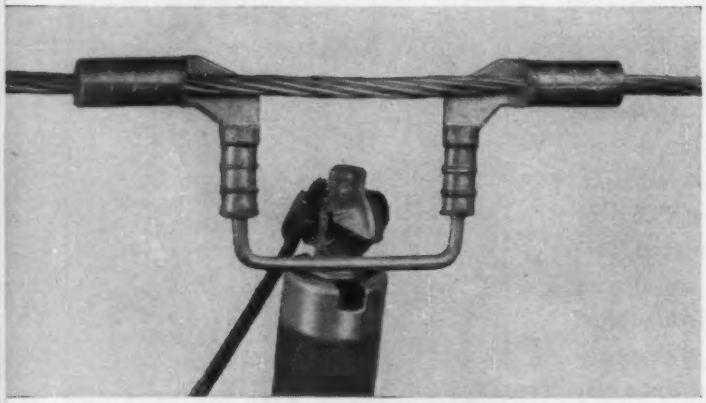
This 450,000 lb/hr Spreader Stoker Fired Riley Unit is one of the largest lignite burning boilers in the world. 1025 Psi., 905 F. **Montana-Dakota Utilities. Ebasco Services, Inc.**



This Riley Reheat Unit is constructed outdoors at **Minnesota Power & Light Company's** Clay Boswell Station. Fired by Riley Pulverizers and coal, gas, oil Burners; has patented Riley Single Header Hopper. **Ebasco Services, Inc.**

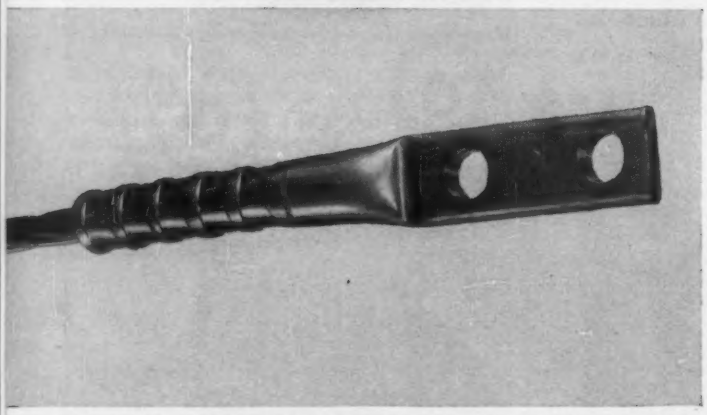
Kearney's compression program

Added versatility and increased application with existing tools—that's what an investment in Kearney Compression can mean for your system. Besides the basic connections—Squeezons, Serv-En Service Entrance Sleeves, Tension Sleeves and others—you receive the advantages of ever widening tool flexibility as Kearney Engineers continue to develop and introduce new Compression Fittings to the field.



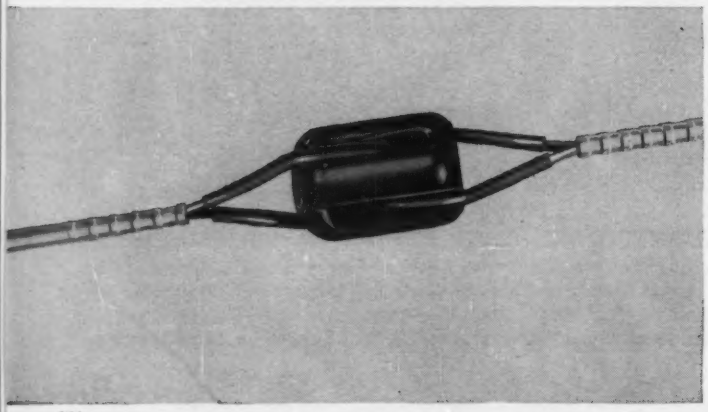
KEARNEY L Squeezon Stirrup

Line side connections are outside the basket—sufficient clearance for either the hydraulic or mechanical tool. The three inch dimension between the line and stirrup makes the unit neat and compact—hot line clamps are readily installed. Unit may be completely covered with line guards.



KEARNEY Compression Terminal

Kearney Compression Terminals provide an efficient method of connecting aluminum conductors to terminal pads. Flaring of strands possible with conventional terminal pads is eliminated. The strands are retained in an aluminum sleeve. Terminals have NEMA 1¾" bolt centers. May also be used as disconnectable jumpers around double dead-ends. The sleeves are filled with Kearnalex Contact Aid and capped and will take conductor sizes from 1/0 to 397.5 MCM 18/1 ACSR.



KEARNEY Insulated Splice

The Insulated Splice was designed primarily for splitting secondaries into shorter sections where additional transformers have been installed and for series street lighting applications. No changes in existing construction are required. Designed for copper, aluminum and ACSR connections, this splice features one piece construction, tension-type sleeves, insulated stainless steel bails and a high strength strain insulator. Splice can be installed with Kearney Hydraulic or Mechanical Tools. ACSR and aluminum sleeves are packed with Kearnalex Contact Aid and plastic capped.

391

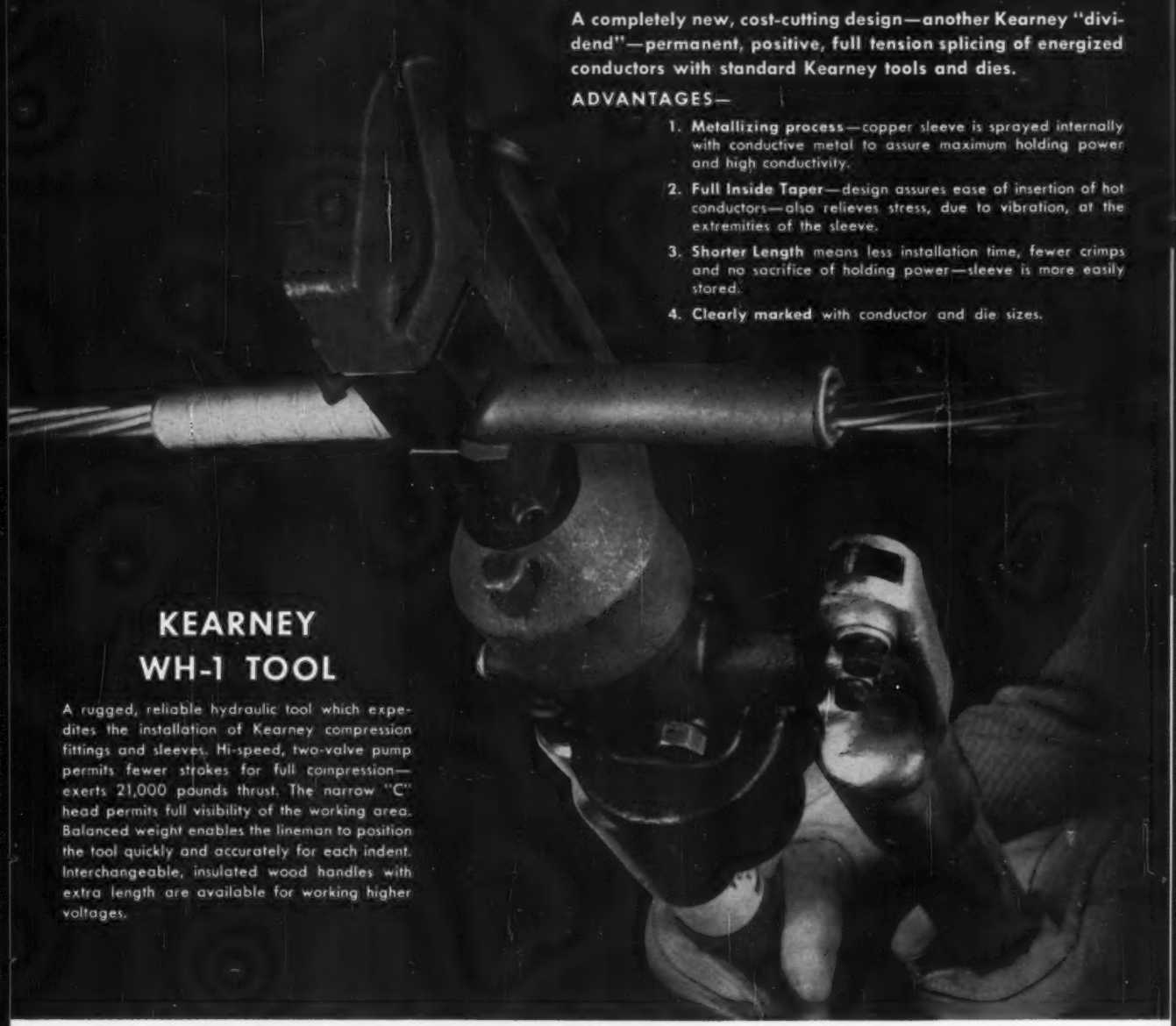
pays extra dividends

KEARNEY INSIDE TAPERED COPPER SLEEVE

A completely new, cost-cutting design—another Kearney "dividend"—permanent, positive, full tension splicing of energized conductors with standard Kearney tools and dies.

ADVANTAGES—

1. **Metallizing process**—copper sleeve is sprayed internally with conductive metal to assure maximum holding power and high conductivity.
2. **Full Inside Taper**—design assures ease of insertion of hot conductors—also relieves stress, due to vibration, at the extremities of the sleeve.
3. **Shorter Length** means less installation time, fewer crimps and no sacrifice of holding power—sleeve is more easily stored.
4. **Clearly marked** with conductor and die sizes.



KEARNEY WH-1 TOOL

A rugged, reliable hydraulic tool which expedites the installation of Kearney compression fittings and sleeves. Hi-speed, two-valve pump permits fewer strokes for full compression—exerts 21,000 pounds thrust. The narrow "C" head permits full visibility of the working area. Balanced weight enables the lineman to position the tool quickly and accurately for each indent. Interchangeable, insulated wood handles with extra length are available for working higher voltages.

FOR BETTER CONSTRUCTION—SAFER MAINTENANCE

Specify Kearney Products

PLANTS AT: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

NOW Pennsylvania ups network transformer capacity to 2500 kva

for new 30-story Office Building

2 BROADWAY, NEW YORK CITY

To satisfy the power demands of the spacious, fully air-conditioned office building to be known as "2 Broadway," Consolidated Edison Company of New York specified a higher-than-ever capacity in network transformers. Six three-phase, 2500-kva Pennsylvania Network Transformers are among the eight being used in this record-setting installation, which provides 265/460Y-volt service from 13750Δ-volt feeders. There are four oil-filled units for sidewalk vaults, and two askarel-filled units for atop the thirty-story structure.

A Pennsylvania Innovation

The units all feature Corrugated Cooling—a Pennsylvania innovation of several years back that has stimulated industry-wide changes in network transformer design.

On Pennsylvania Corrugated-Cooled Network Transformers, conventional tubes and radiators are replaced by radiating chambers that resemble corrugations in the tank walls. The result is a tank with straight, smooth, vertical surfaces—a tank that is easy to clean and easy to paint, even from above the transformer.

Protection Against Corrosion

Low-alloy, high-strength, corrosion-resistant steel is used for the tank, cover, and bottom of vault-type transformers—and also for the radiating chambers of subway-type units. Coupled with the exceptional ease of maintenance and inspection made possible by Corrugated Cooling, this provides highly effective protection against corrosion.

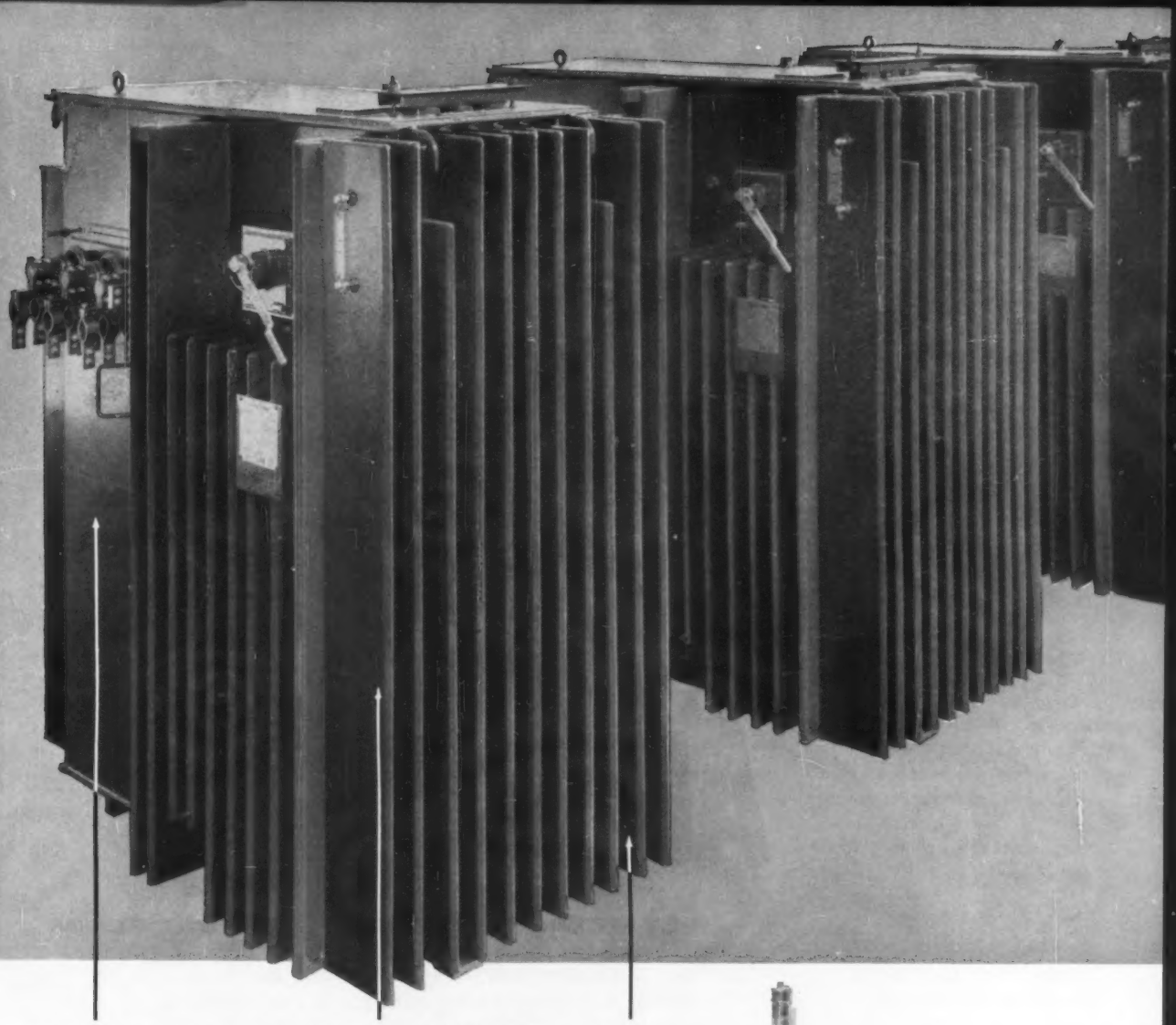
Rigid Space Requirements

In addition to the 2500-kva capacity, special requirements for the 2 Broadway installation included limiting dimensions in all three directions. It is a testimony to the effectiveness of Pennsylvania Transformer's network design that all of these special requirements could be met without any alteration in the electrical and mechanical transformer details.

No matter what type of network transformer your system requires—vault-type or subway-type, suspension-mounted or pedestal-mounted—it will pay you to investigate Pennsylvania Corrugated-Cooled Network Transformers. Contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pennsylvania.

CORRUGATED COOLING

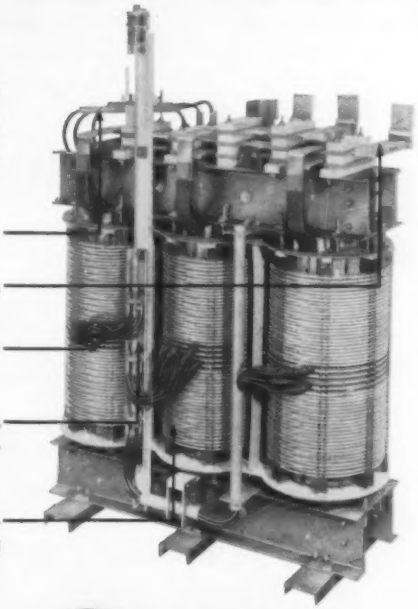
PENNSYLVANIA POWER



Tank shell, cover and bottom are made of low-alloy, high-strength, corrosion-resistant steel—used also for radiating chambers of subway units.

Corrugation-like radiating chambers replace hard-to-clean radiators and tubes. There are no ledges or crevices on which corrosive materials might collect.

Liberal spacing of radiating chambers facilitates maintenance. Transformer is easy to clean and paint, even from above.



High voltage leads are rigidly supported in insulating tubing.

Low voltage bus bars are interleaved to keep copper losses to a minimum. Bars are supported between maple blocks and insulating pads.

Taps are arranged to assure electrical and mechanical balance in the high voltage windings and to minimize the impedance variation over the entire tap range.

Rotary no-load tap changer cannot hang up between contacts. Entire tap changer is housed in a half tube of Pennsylite® to assure adequate vertical insulation phase-to-phase and phase-to-ground.

Pancake-type high voltage coils provide exceptional mechanical strength. In addition, coils are precompressed to pressure equal to maximum short circuit forces that might occur. No additional distortion or displacement can take place.

TRANSFORMERS

pt

McGRAW EDISON

QUESTION:

WHAT IS MOST RELIABLE INSULATING MATERIAL FOR EXPOSED INSULATION?

ANSWER:

WET PROCESS ELECTRICAL PORCELAIN

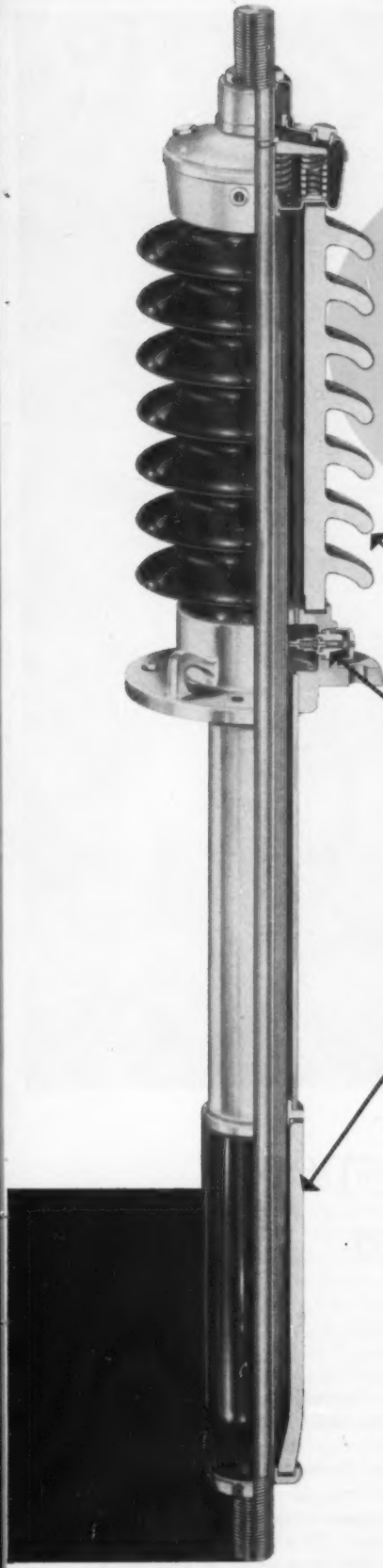
Porcelain is inorganic, non-deteriorating and rugged. At high operating voltages, it can withstand leakage currents without tracking, and without permanent damage to its surface.

Lapp

POC*

BUSHING

*PAPER-OIL CONDENSER TYPE
TOTALLY-ENCLOSED CORE
ASA STANDARD



IN LAPP POC* BUSHING DESIGN

PORCELAIN does 3 big jobs

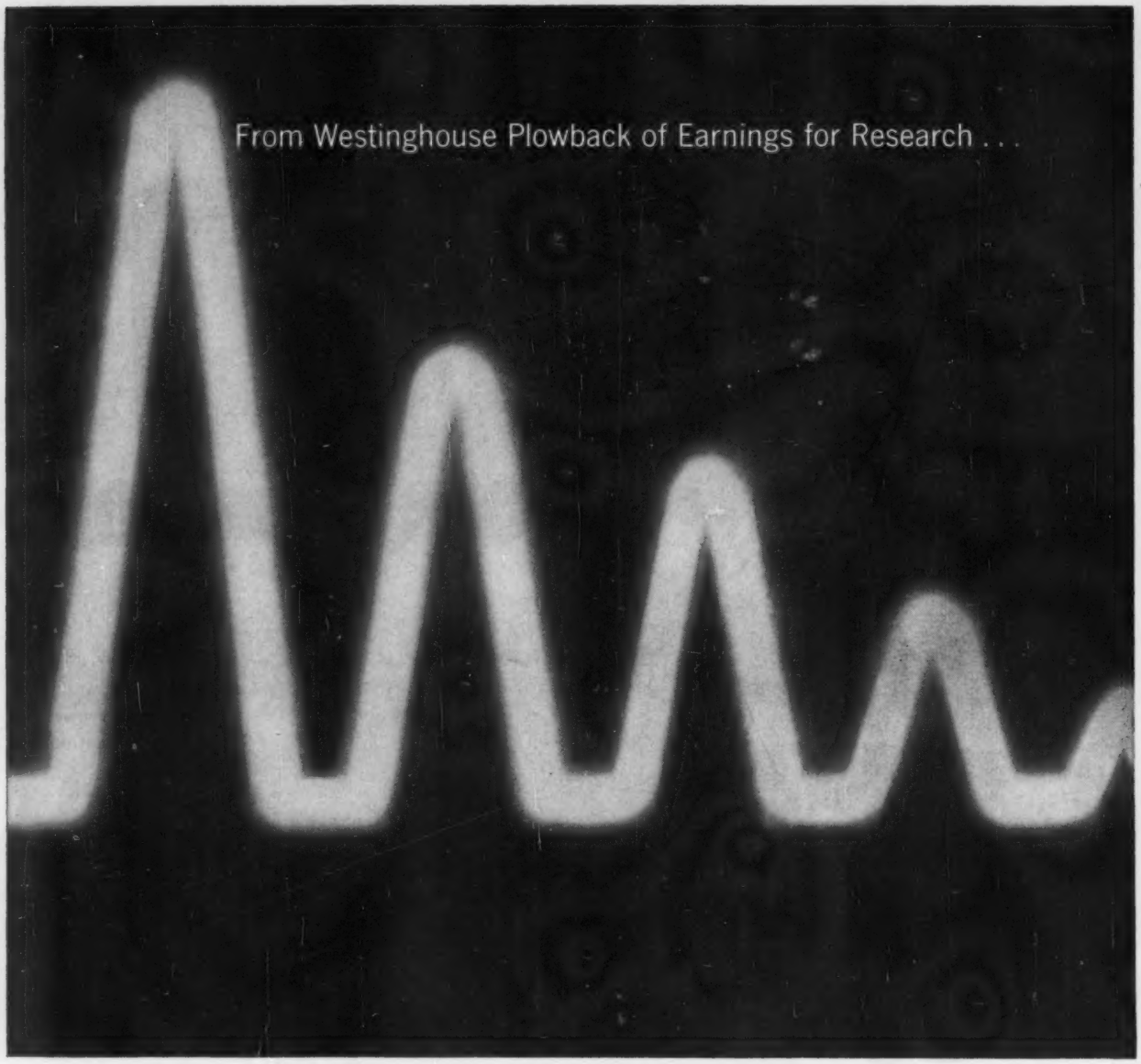
1. WEATHER CASING of porcelain provides flashover distance . . . protects insulated core from moisture and weather . . . and with Lapp Fog-Type corrugations provides most-effective surface to withstand leakage currents under atmospheric contamination.

2. POWER FACTOR TAP is insulated by porcelain; provides permanent uniform insulation . . . assures reliability of power factor test readings.

3. SHANK of porcelain encloses paper-oil core, isolates it from oil in the tank. It has a non-tracking, non-deteriorating surface which will withstand leakage currents which arise from contamination of circuit breaker or transformer oil. Makes storage of spare bushings easy, too, because porcelain shank requires no protection from natural elements.

Lapp Insulator Co., Inc., Le Roy, N. Y.

ALL EXPOSED INSULATION
ON EVERY LAPP POC* BUSHING
. . . FROM 15kv UP . . .
IS LAPP VACUUM-PROCESS
PORCELAIN

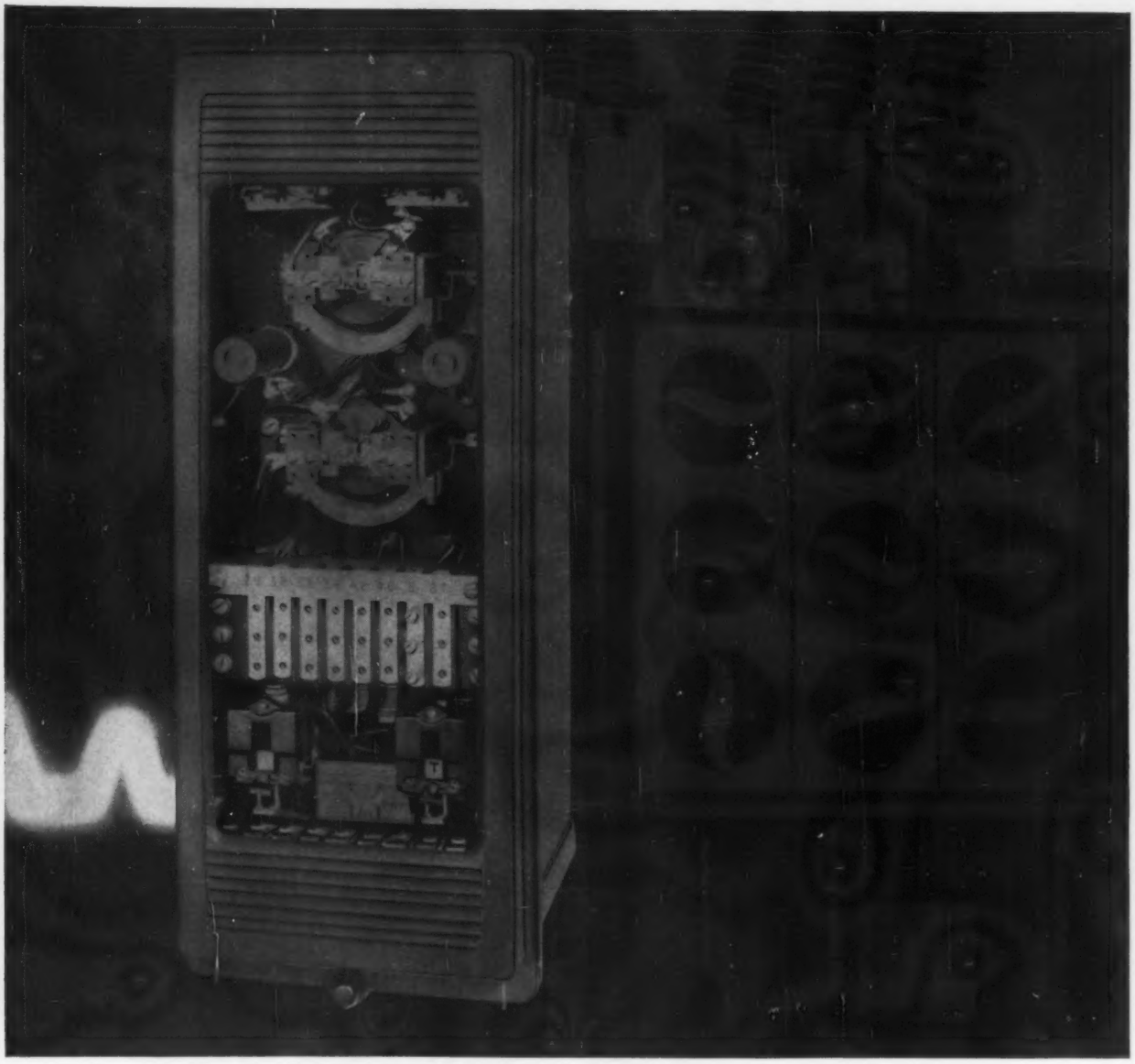


A new measure of high-speed *differential protection* for transformers

In the new Type HU variable percentage differential relay with second harmonic restraint supervision, Westinghouse now offers more complete and reliable protection than ever before available for two-or three-winding transformers.

Restraint supervision, on second harmonic only, prevents false trip-outs on inrush currents. The relay does not restrain on third harmonics, thus providing full protection against heavy internal faults. The variable percentage operating characteristic eliminates the need for sensitivity taps on the relay, yet provides sensitive detection of light internal faults and ample restraint for heavy external faults.

Two high-speed polar-type units in the HU relay provide simplified operation: (1) a differential unit to distinguish between internal or external faults; (2) a

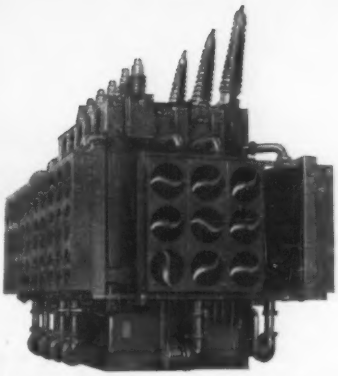


harmonic restraint supervising unit to distinguish between inrush and fault currents.

The harmonic differential units will operate in 1.5 to 2.5 cycles; and the instantaneous trip unit will operate in ¾ cycle for heavy internal faults. The relay has low burden, requiring about three volt-amperes at tap value current. Built-in ratio taps compensate for mismatch of line current transformers on both two-and three-winding applications.

Adequate transformer protection is also provided during reduced frequency operation, such as exists during the generator warm-up period.

For further details about HU relay transformer protection, call your Westinghouse sales engineer or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-40604

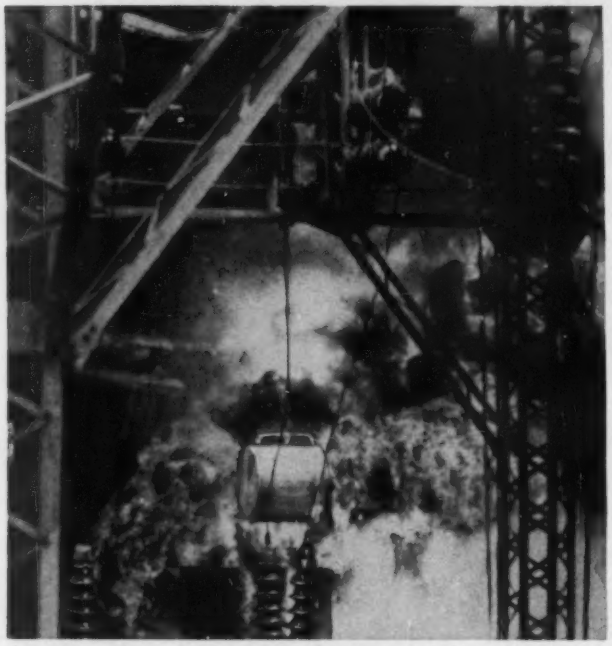


Type HU relay protects two-winding transformers; HU-1 for use with three-winding transformers

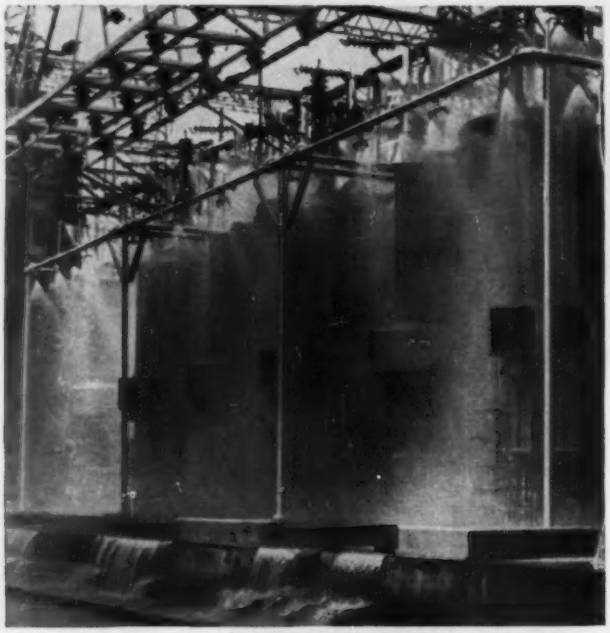
YOU CAN BE SURE...IF IT'S

Westinghouse

Transformer Fires!



Transformer fire at this power station caused an estimated $50,000 damage. There was no special fire protection system on guard.



Transformers at this power station are safeguarded by a Grinnell Mulsifyre System. Mulsifyre's fast, automatic spray action is being demonstrated.

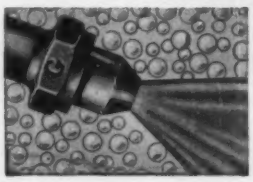
When fire occurs, you can depend on GRINNELL MULSIFYRE to extinguish it... fast

A Grinnell Mulsifyre System is effective wherever the danger of fire in medium or heavy oils can be limited to a definite area. Grinnell Mulsifyre Spray Projectors usually have the fire *completely* out in a matter of seconds after the water discharge starts.

Three recent transformer fires which prove the ability of Grinnell Mulsifyre to put out oil fires quickly.

- Considerable oil was spilled when there was a failure in a 100,000 KVA transformer. The flash fire which resulted was immediately extinguished by the automatic operation of a Grinnell Mulsifyre System. This fire, if not checked, could have destroyed transformer, an adjacent transformer of equal capacity, and associated bus structure.
- In another utility fire, the cause originated with a faulty H. T. bushing on a 50,000 KVA transformer. A break in the bushing sprayed burning oil over the surrounding equipment. The heat-activated Mulsifyre System took only 20 to 30 seconds to extinguish fire on the bank.
- Bushing failure resulted in still another fire in a 150,000 KVA transformer. This transformer was protected by a manually controlled Mulsifyre System. Fire was rapidly extinguished upon manual operation of system except for blaze at the top of the bushing which was above the space protected by the Mulsifyre system. Fire damage to transformer was limited to fan blades and blistered paint on radiators.

For detailed information, write . . . Grinnell Company, Inc., 277 West Exchange Street, Providence, R. I. Branch offices in principal cities.



GRINNELL *Mulsifyre*

EMULSION EXTINGUISHMENT OF OIL FIRES

21 SIZES!

Series LC 50

Series LC 80

Series LC 500

Series LC 800

Now! Completely new lines of one bolt connectors in 21 sizes . . . a size for every application need—#8 ACSR to 336.4 MCM ACSR with armor! "Wrap-around top" may be worked "hot," for faster, easier installation. New top curvature design under bolt head reduces relaxation and bolt bending. Full length, high pressure contact area . . . no lost "overhang". Heavy side fingers interlock for secure cable containment in all aluminum to aluminum connections. Series LC 50 and 80 available bare or plated. Series LC 500 and 800 have copper liners. All pre-inhibited at no extra charge. At slight additional cost connectors may be supplied with grooves filled with a special inhibitor and then sealed in Kleen-Seel polyethylene bags.

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how to coordinate SMD Power Fuses for maximum protection

a case study using a new "step-by-step" technique

A common error in fusing the primary of a power transformer is the selection of a fuse of such a speed and ampere rating that the full protection capability of the modern fuse is not put to use.

Properly selected, a modern power fuse can provide for

1. system protection,
2. transformer protection against secondary faults, even line-to-ground,
3. use of transformer short-time daily overload capability,
4. use of transformer short-time emergency overload capability, and
5. complete and precise coordination with other overcurrent devices.

The selection of the right fuse, however, has not been easy, since there has been until now no commonly and consistently agreed upon method of coordination; and only meager information about fuse performance has been available.

Consequently, a new "step-by-step" method for power fuse coordination has been developed by S&C. Supported with all necessary power fuse performance data, this method utilizes the full protection capability of the *modern* power fuse; furthermore, it lends itself to general acceptance and universal use because its development was based on the realistic recognition of

1. the duties the user desires to impose today on a power fuse, and
2. the contradictions in power fuse selection work—the need for simplicity on the one hand and the need for precision on the other.

The case study which follows illustrates the new step-by-step method. It concerns the selection, specifically, of the proper SMD Fuse Unit for application on a power transformer primary.

• • • •

Case Data:

Transformer Bank:
7500 kva, 3-phase, self-cooled.
Primary voltage: 69 kv delta
Secondary voltage: 7.2/12.47 kv wye

Short Circuit Maximum:
Primary: 750,000 kva
Secondary: 80,000 kva (bus fault)

Secondary Breaker:
Ampere Rating: 1200
Reclosing Time: 10-40-100 sec.
Relay-breaker characteristic shown by curve, Figures D and G

Procedure:

Using the S&C Data Bulletin 262, open the front cover to the step-by-step outline shown in Fig. A.

Step 1: Select voltage rating of fuse to equal or to exceed line-to-line voltage of the system—69 kv.

Step 2: Check for adequate interrupting rating (Fig. B). Since the maximum available short-circuit is 750,000 kva, the correct fuse unit is SMD-2.

Step 3: Establish the minimum ampere rating of the fuse unit. In this case use the table for self-cooled or water-cooled power transformers (Fig. C). *(Similar tables are provided for forced-air-cooled power transformers and for potential and distribution transformers.)* The fuse unit ratings in this table have been selected to carry normal short-time daily overloads of the magnitudes established by ASA in the publication, "Guide for Loading Oil-Immersed Distribution Transformers and Power Transformers." No *additional* allowance need be made. Per Fig. C under the proper voltage (69 kv) and proper kva (7500), the correct fuse unit ampere rating is 100E.

Step 4: Check coordination. Here are two ways: (1) Rule-of-Thumb Method (satisfactory in most cases) and (2) Precise Method (used when the Rule-of-Thumb Method apparently indicates that coordination is impossible).

SECONDARY FAULTS—RULE-OF-THUMB METHOD, FIGURE D.

First: Establish the fault conditions under which coordination is to be checked and compute the fault current levels. In this example, a 3-phase secondary bus fault is assumed, resulting in a primary fault current of 680 amperes (see ① in Fig. D).

Second: At this fault current level, read from the time-current characteristic curve the minimum melting time for this fuse unit, 100E amperes—Standard Speed assumed. This gives Point ② in Fig. D of 0.49 seconds.

Third: Multiply this time by .55—giving 0.27 seconds—thus establishing Point ③, the allowable minimum margin between fuse and breaker-relay curves. The factor .55 makes allowances for variations in ambient temperature and for full preloading of the fuse,

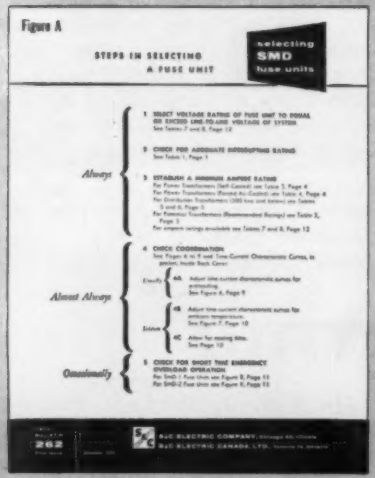


Figure A

STEPS IN SELECTING A FUSE UNIT

selecting SMD fuse units

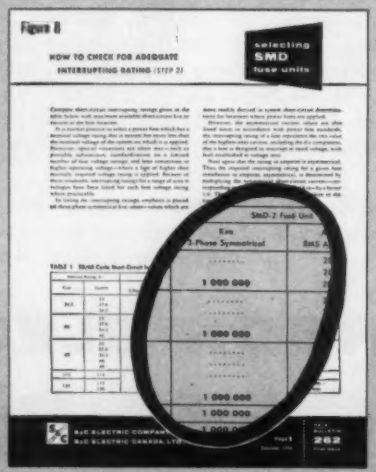


Figure B

HOW TO CHECK FOR ADEQUATE INTERRUPTING RATING (STEP 2)

selecting SMD fuse units

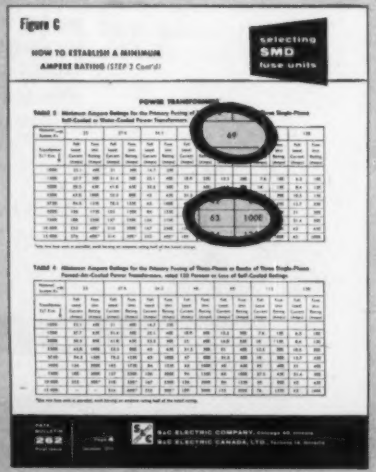


Figure C

HOW TO ESTABLISH A MINIMUM AMPERE RATING (STEP 3 Cont'd)

selecting SMD fuse units

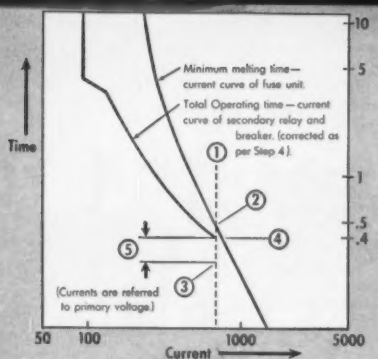


Figure D. Coordination by THE RULE-OF-THUMB METHOD — Secondary Faults

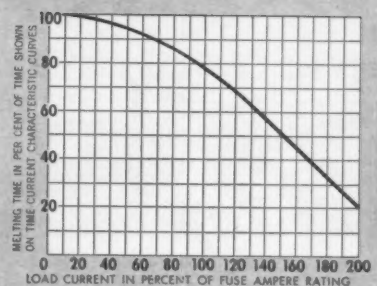

MELTING TIME IN PER CENT OF TIME SHOWN ON TIME CURRENT CHARACTERISTIC CURVES
100
80
60
40
20
0 20 40 60 80 100 120 140 160 180 200
LOAD CURRENT IN PERCENT OF FUSE AMPERE RATING

Figure E. Preloading Adjustment Factors — Standard and Slow Speeds

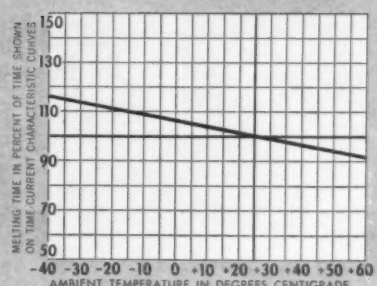


Figure F. Ambient Temperature Adjustment Factors

even from daily overloading of the transformer bank.

Fourth: Read from total operating time-current characteristic curve of secondary relay-and-breaker the operating time, Point ④, for this current level—0.40 seconds.

Conclusion: Coordination is not obtained since the time of Point ④ exceeds that of Point ③ by the amount shown at Point ⑤.

The next step is to recheck coordination, assuming a *Slow Speed* 100E ampere fuse unit. Here again, using the Rule-of-Thumb Method, coordination is not obtained. At this point, rather than to select a higher ampere rating which would sacrifice transformer protection, recheck coordination by the Precise Method.

SECONDARY FAULTS—PRECISE METHOD (an alternate to the Rule-of-Thumb Method), FIGURE G.

This method involves a comparison of the time-current characteristic curves of the selected fuse unit and the secondary breaker-and-relay *after both curves have been corrected* for the various factors that affect coordination. (See Fig. G below.) Factors for correcting relay and breaker curves are obtained from relay and breaker manufacturers.

The factors which apply to the fuse units are discussed below. They are:

- Adjustment for Preloading (see Fig. E above)
- Adjustment for Ambient Temperature (see Fig. F above)
- Allowance for the effect of cumulative heating and cooling of the fuse element during successive breaker operations (heating while short-circuit current flows, then cooling between breaker operations). Where the open-circuit time interval is less than ½ second, no allowance for cooling of the element is necessary; where the interval is 2 seconds or more (as it is in this case), the element will cool to a degree where cumulative heating need not be considered. (For intervals between ½ and 2 seconds, the full details on cooling time allowances are found in Data Bulletin 262.)

In this particular fusing problem, coordination with the secondary breaker-and-relay has been obtained by the Precise Method, since, in Fig. G, the time ② on the corrected fuse curve is greater than the total relay-breaker time ③ for this current level. This difference is indicated by ④. Were this not the case, using a Standard Speed Fuse unit, then a recheck would be made, using a fuse unit of the same ampere rating but Slow Speed. Do this rather than going to a higher ampere rating, since a higher rated fuse unit offers less protection to the transformer. If the Slow Speed does not coordinate satisfactorily, *then* recheck, using the next higher ampere rating in the Standard Speed.

PRIMARY FAULTS, FIGURE H.

For both Rule-of-Thumb and Precise Coordination Methods the same practice is used. No adjustments or margins are required. Coordination at fault level ① will be obtained where the total clearing time of the fuse unit ③ is equal to or less than the tripping time ② of the line breaker relay. ④ Indicates margin.

Step 5: Check for Short-Time Emergency Overload Operation.

These curves (Fig. I) show the ability of an SMD Fuse Unit to carry emergency overloads after carrying rated load. This overload situation arises, for example, when one transformer on a duplex substation is out of service for repairs or maintenance, putting the entire load on the other transformer and its fuses. The curves are based on an ambient of 30°C and represent the maximum *nonrepetitive* overload (in per cent of ampere rating) that an SMD Fuse Unit can carry for a given time without impairing its ability to perform properly. For each degree above or below 30°C, the capability may be adjusted 0.3 per cent.

• • • •

The above case study is a brief summary of a fusing problem solved by using the complete 12-page Data Bulletin 262 entitled, "Selecting SMD Fuse Units," published by S&C Electric Company. This bulletin with 8 Time-Current Characteristic Curves and a comprehensive text on coordination is yours for the asking.

S&C Electric Company, 4421 Ravenswood Avenue, Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

S&C ELECTRIC COMPANY

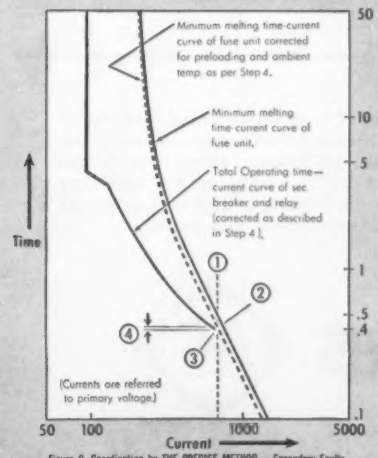


Figure G. Coordination by THE PRECISE METHOD — Secondary Faults

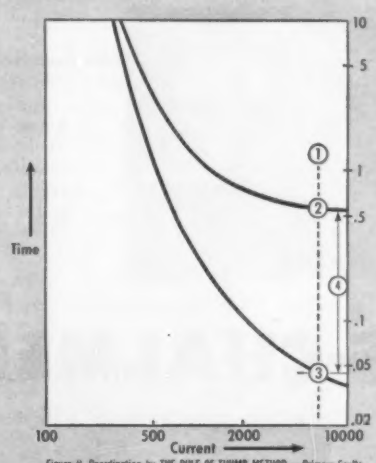


Figure H. Coordination by THE RULE-OF-THUMB METHOD — Primary Faults

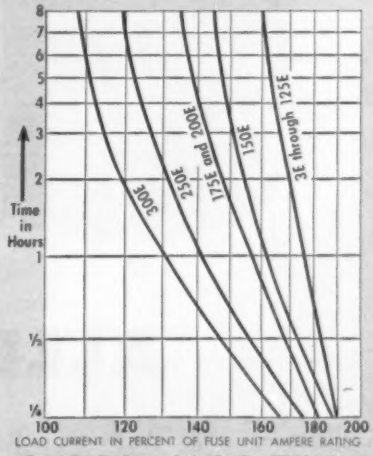
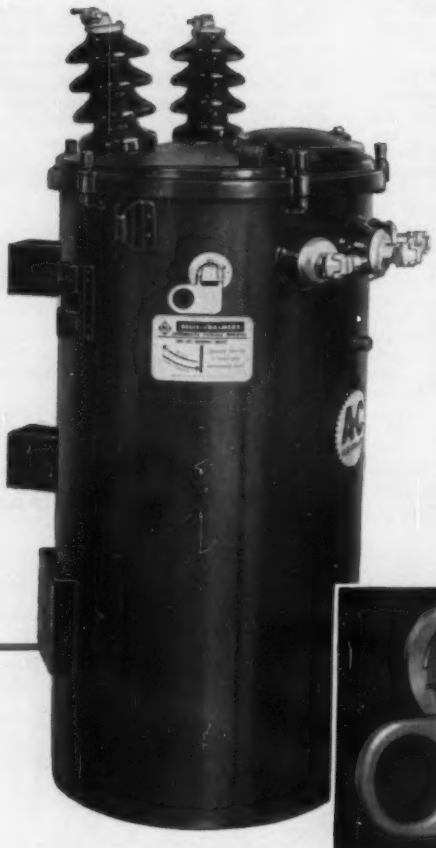


Figure I. Short Time Emergency Overload Capability — SMD-2 Fuse Units

***Thermalite* Overload Indicator...**
Quickest, Most Economical
Way to Detect

Summer Overloads



THE brilliant red warning light of the *Thermalite* device on Allis-Chalmers distribution transformers can be spotted from hundreds of feet away by a cruising service truck. The inexpensive *Thermalite* device eliminates the need for expensive complete surveys to detect transformers overloaded by air-conditioning and other cooling equipment during the summer.

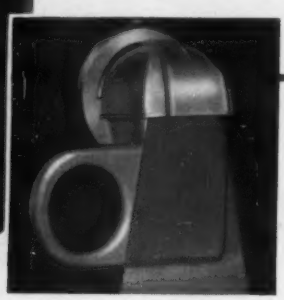
No False Alarms or Service Interruptions

The *Thermalite* overload indicator does not respond to temporary overloads. It takes these load factors into account automatically: high ambient, amount of overload, duration of overload. Because it does not interrupt service in *any way*, replacement or other system changes can be made at your convenience.

Greater Utilization

You can stretch transformer dollars by taking advantage of the inherent overload capabilities of distribution transformers on your system. *Thermalite* overload indicators let you use this capability without disrupting service continuity.

Thermalite is an Allis-Chalmers trademark.



Low-cost *Thermalite* overload indicators are available on Allis-Chalmers distribution transformers 167 kva and smaller, 15 kv and below. For details, call your A-C office, or write to Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

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A-5698

Editorial Comment

June 2, 1958

Can Old Units Meet New Peaks?

Installing new capacity specifically for peaking operating has been the exception rather than the rule. But changing conditions may alter this arrangement in the future. The reason why new peaking capacity has not been attractive in the past is quite obvious. Old, depreciated steam equipment has usually been available to supply power for those short periods of time when the system load increases sharply. The fuel and operating costs of these old units are very high but the economics are still in favor of their use because of the short periods of time they will be needed and because they are available without extra investment.

This method of providing peaking capacity however may not continue to be available in the future. This is particularly true of systems that have had their greatest growth in recent years. These systems are undoubtedly being saturated with modern, efficient equipment. And as their loads and peaks continue to grow their old equipment will not be able to supply all of the peaking capacity.

Faced with this situation should these utilities continue to install the best equipment available and use some existing modern equipment for peaking, or should they install equipment specifically designed for peaking operation? Today with heat rates of the best available units not appreciably better than the heat rates of the units already on the system, this question becomes more difficult to answer.

Like many other problems facing the utility industry today this problem of peaking capacity will vary with the different operating systems. However, peaking capacity provided by several types of prime movers is available today and it is never too soon to evaluate their merits.

Hey, Mister, Is That Atomic Electricity?

With the first announcement in 1945 of the awesome power of atomic energy, the general public formed two basic opinions: Atomic energy is an unknown and it is powerful. Thus, it is something to be feared or regarded apprehensively at the very least. Subsequent and sometimes conflicting information on atomic radiation and fallout has done very little to clear up the initial unknown and fearful aspects of this new force in the public mind.

So it comes as no surprise to the electric industry, at the dawn of successful peaceful application of atomic energy, that there is confusion, ignorance and fear over nuclear power plants and their product—"atomic electricity." While many companies have taken great engineering strides toward economic nuclear power, only a relative handful have paralleled this progress in providing straight, understandable information about nuclear power.

A recent issue of Toledo Edison Co's employee magazine suggests how the public might be informed. An article entitled "Hey mister—is that atomic electricity?" aims to satisfy the intellectual curiosity which is basic to all people, and at the same time dispel the fear of atomic energy as an unknown. It emphasizes that "atomic electricity" means only that the source of heat will be different; the electricity, and the equipment for supplying and using it, will be the same. It concludes that "you can call it 'atomic electricity' if you want to, just so you understand what makes it 'atomic'."

Toledo Edison, a member of Power Reactor Development Corp, is not building or planning a nuclear plant on its own system. But it has recognized that right now is soon enough to satisfy a public that will be asking more questions like "Is that atomic electricity?"

From 1954 model . . .

To fifth month of operation . . .

World's Eyes Turn to Shippingport

Although dimmed by the absence of the President and the five-month lag between start-up and dedication, last Monday's ceremonies at Shippingport nonetheless found the world's attention again focused on the first atomic power station devoted solely to civilian uses.

President Eisenhower, with a beam of neutrons, dedicated the pressurized water reactor from the White House. Shippingport "represents what can be done, not only in America, but throughout the world, to put the atom to work for the good of mankind, not for its destruction," he said.

Philip A. Fleger, Duquesne Light Co board chairman, said the 200-year span from discovery of oil near Shippingport to the atomic age has been one in which "the American way has ever been to push back the frontiers." Lessons learned from building the joint Atomic Energy Commission-Duquesne project, and the ones to be learned in operating it, will contribute to efficiency and economy of future stations in the free world, he said.

"Shippingport is our answer to Mr. Khrushchev and his sputniks," said Rep James E. Van Zandt (R-Pa.). The ranking minority member on the Joint Committee on Atomic Energy, Van Zandt said, "We believe that through the normal American incentives . . . we will develop atomic power.

Perhaps a partnership formula "could be followed to build five or ten more reactors," he said, if the preference clause in the Atomic Energy Act could be modified. The result would be that "we could obtain both plutonium and power and advance the reactor art in our country . . ."

Mark W. Cresap, Jr, president of Westinghouse Electric Corp, said the plant's potential "challenges our minds and our imaginations." Westinghouse designed and developed the station's reactor.

Reactor Facts Available: Strauss

Lewis L. Strauss, AEC chairman, said, "In three years and nine months . . . the cooperative efforts of government and private industry have brought this plant into being." All the information on the Shippingport reactor and other AEC-aided civilian power reactors "is fully available to those who can use it."

With the atom's energy unlocked, "man holds in his hands the power to change his environment," said Adm H. G. Rickover, AEC's chief of naval reactors. "This power . . . imposes on man a great moral and political responsibility in attempting to do God's work. God help us if we don't do it wisely," Rickover added.

The chronological background on Shippingport goes like this:

October 22, 1953—AEC Commissioner Murray disclosed that the U. S. would build a full-scale civilian atomic power plant. The reactor "is America's answer—its significant peacetime answer—to recent Soviet atomic weapon tests. It should show the world that, even in this gravest phase of arming for defense, America's eyes are still on the peaceful future," he said. Development, design and construction of the plant were assigned to Westinghouse Electric Corp.

March 14, 1954—AEC announced that Duquesne Light Co had been selected to build the generating plant and operate the completed reactor.

September 6, 1954—Shippingport groundbreaking signaled by President Eisenhower when he waved a neutron wand that started an electronically operated bulldozer at the site to scoop up the first earth. It was 75 years after the invention of the electric light.

December 2, 1957—Reactor went critical.

December 23, 1957—Full power achieved.

May 26, 1958—Formal dedication of the project.

Designed for an ultimate capacity of 100,000 kw, the Shippingport reactor station now has a gross generating capacity of 68,000 kw.

Based on the 100,000-kw ultimate, total plant cost comes to $680 per kw. Total cost of the reactor was $50.5 million and the turbogenerator plant was $17.5 million.

Cost of Shippingport power at the busbar is 65 mills per kwhr.

U. S. Power Pace Maintains Lead Over Russia

America has developed about 23% of its potential hydro while U. S. S. R. total stands at 2.5%, FPC figures show. To catch up with U. S. by 1975, Russia would have to install capacity at four times her 1950-56 rate

The Soviet Union's recent installations of large hydro projects has been the subject of congressional reappraisals of how America's power pace compares. Francis L. Adams, Federal Power Commission's bureau of power chief, last fortnight provided a comprehensive picture on both the present and the outlook for the future.

Total U. S. generating capacity in 1975 is expected to hit 351 million kw, with annual production of 1,631 billion kwhr, Adams told the Senate committees on Interior and Insular Affairs and Public Works. Estimates include power companies, governmental utilities, and industrial plants.

The U. S. capacity figure stands at 145.7 million kw today, with annual production of 716 billion kwhr. Total hydro capacity accounts for 19% of America's overall capacity.

Russia's total installed generating capacity at the end of 1956 amounted to 42,795,000 kw. The yearly output stood at about 192 billion kwhr, of which 163 billion kwhr was generated in thermal plants and 29 billion in hydro plants, Adams said.

Russia Has Vast Hydro Potential

Total estimated potential hydro power in Russia is about 340 million kw of capacity. This is three to five times the estimated 90-million kw hydro potential in the U. S.

"It appears that about 2.5% of the total Russian potential has been developed as compared with 23% development in the U. S.," Adams said.

In charting the two countries capacity pace, he brought out that "the U. S. superiority has more than doubled since 1940, having increased from 39,962,000 kw in 1940 to 94,547,000 kw in 1956."

Per capita energy production in 1957 hit 4,202 kwhr in the U. S. By 1975 it will reach 7,140 kwhr. Russia's per capita production amounted to 959 kwhr in 1956.

The charted comparisons "shows graphically how the U. S. has been out-distancing Russia in the installation of electric generating capacity," Adams said.

"If Russia is to catch up with the U. S. by 1975 it must install new capacity at the unprecedented rate of 16.2 million kw annually, or at a rate more than four times their actual rate (3,399,000 kw) during the six-year period, 1950-56, and nearly three times their maximum annual rate of installation (5,564,000 kw) during that period," Adams concluded.

Kefauver Scores TVA Proposal

The TVA will be destroyed if proposals to strip the authority of its power functions are carried out, Sen Estes Kefauver recently warned the Tennessee Municipal League. He said the enemies of TVA are first trying to destroy its unified program.

"Some are proposing," he said, "that municipalities, states and power districts take on the responsibility" for programs now carried on by TVA.

"I feel that this will be ultimately self-defeating because it destroys the very assumption on which the TVA has operated and takes too short a view of human affairs."

The recommendations that political subdivisions assume the responsibilities now shouldered by TVA would result in "a splintering of the unity that has so characterized our efforts" on behalf of TVA heretofore, Kefauver said.

"There would be a tendency not necessarily out of selfishness but more out of unfamiliarity with the problems of others, to be concerned about local interests rather than the public interests," he said.

He foresaw fights between power districts or municipalities over sufficient power for their respective units, fights between navigation interests and power interests over which has the prior right.

"Conflicts of this sort have arisen in the past, of course," Kefauver said, "but they have been settled because the public interest was always kept in the foreground and the local and private interests were required to meet the standards which the public interest imposed."

This was possible, he said, because of the unified character of the Tennessee Valley Authority.

Co-op's Board Under Fire

Two Iowa contractor associations are up in arms over what they describe as an arbitrary directive of the Corn Belt Power Cooperative's board of directors. The board decreed that bidding for a 33,000-kw steam plant at Spencer should be limited to concerns using union labor, according to the contractors.

The directive was a violation of the state's right-to-work laws and of the federal Taft-Hartley law, they add. Neither union nor non-union labor should be discriminated against in public projects, they contend.

Henry Hope, the generation and transmission co-op's general manager, told Electrical World that the charges are purely "name calling." One contractor using non-union labor has been on the job since ground was broken two months ago, Hope said. He added, however, that he felt it was "the board's prerogative" to say what kind of help it wanted.

ELLIS: Long an advocate

The Job Ahead for REA: II. Changing Co-op Loads

Pace amendment in '44 helped systems blanket their areas. Trend of bigger G&T developments and interconnections with federal projects bring changes in power sources

The end of the Rural Electrification Administration as an independent agency came on July 1, 1939, when President Roosevelt placed it under the Agriculture Department to reduce the number of recently-created federal agencies. John Carmody, who had been appointed REA administrator two years earlier, quit in protest. He claimed the technical staff he had set up would soon be lost under direction of a politically-appointed cabinet official. Carmody quipped:

"The only justification for putting the REA in the Agriculture Department is because the first word in its title is 'rural.'" Regardless, the REA staff soon grew to 750.

Harry Slattery, named to head the agency in September, 1939, served six rocky years before resigning in 1945. During his administration, the REA was moved to St. Louis under World War II dispersal orders; the legal staff was placed under the Agriculture Department's legal department; the National Rural Electric Cooperative Association was born; congressional hearings were held on an internal REA fight; and the Pace amendment was enacted by Congress, indefinitely extending a liberalized loan program for rural borrowers. During this same period, REA borrowers expanded their annual power purchases from slightly over 400-million kwhr to 3 billion kwhr.

Slattery came under attack in 1943 by the newly-formed NRECA when he refused to permit the association to set up its own mutual insurance companies. Clyde T. Ellis, NRECA executive manager, felt Slattery's denial was a turn-around from REA's previous approval of the plan. Their fight led to other rifts within the REA, including a feud between Slattery and his deputy, Robert B. Craig.

Ellis had come to the co-op association directly from two terms in Congress as a representative from Arkansas. Long an advocate of federal power, he had promoted the REA while in Congress. He was defeated in 1942 by John McClellan in the Democratic primary for a U.S. Senate seat.

A Senate agriculture subcommittee, headed by Sen "Cotton Ed" Smith, of South Carolina, held extended hearings into the fight between Slattery and Craig and on charges that the REA was discriminating against the aluminum industry by requiring copper conductors in its engineering specifications. The proceedings produced more heat than light, and an indecisive report finally was issued.

By the end of World War II, nearly 50% of the nation's farms were receiving central station power and the ten-year loan program—set forth in the 1936 law—was nearing an end. Private utilities insisted that to extend the rural electrification program further would be economically wasteful. In fact, they contended, some co-ops were tending to ignore service in sparsely-settled areas within their territories.

In order to encourage rural systems to blanket their areas, Congress passed the Pace amendment in late 1944, indefinitely extending the loan program, increasing the permissible loan amortization period from 25 to 35 years and reducing the interest rates to a rigid 2%.

Claude R. Wickard, secretary of Agriculture, stepped down to succeed Slattery as administrator in 1945. During his administration the headquarters were moved back to Washington from St. Louis and a rural telephone loan program was set up under REA by Congress. Rural power use had grown to 13 billion kwhr annual in 1953, and 90% of the nation's rural households had been connected.

Ancher Nelsen replaced Wickard in 1953 after Eisenhower was inaugurated. Criticism grew during this period of the long established policy of issuing loans to federated or "super-co-ops" for construction of their own generating and transmission (G&T) facilities. Some of this power was sold to new industrial customers in rural areas, bringing up the issue of whether loans for G&T facilities to supply non-farm consumers, were within the intent of Congress when it voted the REA Act.

A suit had been filed back in 1950 by ten power companies in Missouri to enjoin the Central Electric Power Cooperative and the Northwest Electric Power Cooperative, Inc—both Missouri co-ops—from building G&T facilities in excess of their immediate needs; but the U. S. Supreme Court upheld the loans. Super co-ops have existed from REA's earliest days. However, loan applications from such groups have grown larger and larger, reaching a peak in the request of Indiana's Hoosier Cooperative Energy, Inc, for $42 million to build a plant.

Here's how REA power sources have changed since 1940

	1940	Today
Private companies	53%	44%
Municipals	16%	2%
Self-generated	4%	10%
Federal projects	27%	44%

PA's View Delivery Problems

Following are excerpts from a report to the Edison Electric Institute's Purchasing and Stores Committee meeting held in Minneapolis on April 28. Questions and answers are by members of a project group headed by R. Gear, Director of Purchases, Commonwealth Edison. While some of the criticisms leveled at vendors are not now pertinent according to the PA's, they were applicable six to nine months ago.

Q. How early do shipments or deliveries have to be before they are refused?

A. Two weeks to thirty days for items of small value made little difference. On major equipment, arrival thirty to sixty days in advance to schedule may be permitted provided (1) there is no storage or additional handling problem involved, and (2) that the billing be deferred or the payment held up until the specified delivery date.

Q. What action is taken when vendors are habitually late with deliveries?

A. This is cause for considering dropping this vendor from the list of suppliers. The current economic situation has eased the situation on late deliveries but it is still prevalent in the area of major equipment such as boilers, turbines and other specially designed products.

Q. In placing an order where delivery is most important to meet a construction schedule, should one not insist on sales personnel being more realistic in quoting delivery date and to have it substantiated by production personnel prior to the time that the order is placed?

A. All members agreed that they have stressed the need for accuracy of shipping schedules quoted and that they be checked with vendors' production departments to insure that the delivery date quoted is factual.

Q. Does the salesman accept the fact that he is, in effect, working for you . . . that he sometimes must fight to maintain or improve delivery dates, if required, in his own organization?

A. Most salesmen accept this fact, particularly where they have been doing business with the buyer's company for an extended period of time. Communication is a problem in the supplier's plant just as it appears to be a problem in our own organizations. Salesmen are not always given the current information by their own people. If this happens frequently, we should be very skeptical about giving them more business.

Q. To make routine expediting less expensive, should we not insist on manufacturers giving complete information concerning deliveries on first request rather than a vague reply which makes it necessary to go back for information that should have been furnished in the original reply?

A. Many concerns answer these questions with inexperienced clerks who fail to check production before replying. On major items most people insist on the manufacturer furnishing a shop fabrication schedule showing shop material order points, shop time, test and shipping dates. Here the expediter, buyer and the salesman must collaborate to obtain the correct information for the buyer's engineers and construction people.

Q. Are our expediters well enough acquainted with manufacturer's plant personnel and plant facilities to evaluate proper delivery information given to them and to secure additional data if needed?

A. There is no problem in expediting for supplies. For major equipment, an expediter must become well acquainted with manufacturer's personnel and plant facilities in order to accomplish his job satisfactorily.

Q. Do you keep a performance file? Does it show the reliability of vendors' delivery promises?

A. The answer to this question is generally "no". However, even though the answer was "no" on the questionnaire, I am sure that in everybody's mind remains the memory of bad performance more times than the memory of good performance. A written record will give a better balance to the evaluation of a supplier. It need not be elaborate.

Q. Are vendors furnishing the service you expect?

A. An overwhelming majority indicated that most vendors were trying to render the service we expect. One commented on the "eager beaver" type of salesman who makes rash delivery promises without consulting with his production people. Three people commented that some of the workmanship in the past few years has not been of the top flight quality previously provided. Two others commented about the trouble in securing manufacturers' drawings necessary for approval. Several felt that the buyers were not giving enough time for the manufacturer to do their engineering and scheduling in ample time for production.

Tips to Purchasing Agents

- Furnish the vendor realistic delivery dates or thoroughly explain and obtain acceptance of short time dates prior to placing the order.
- Insist on vendor living up to delivery dates.
- Don't accept a delivery date which it appears a vendor may have offered thinking it will get him an order.
- Keep your communications' channels active, both within your own company and to the vendor. Inform the vendor of changes in order requirements if they occur.
- Keep well acquainted with the economic side of your company.
- If the vendor renders adequate service from the initial quotation to the satisfactory service date, keep him in mind the next time.

Morse Blasts Administration at

- **American Public Power Association hears Oregon Democrat hit the Eisenhower power program for "negative action"**
- **Senator Hill tells of "unceasing fight against TVA;" Olds and Swidler discuss power supply and legislation**
- **Status of nuclear power development is studied; experts recommend federal support for U. S. and foreign plants**

The American Public Power Association met in New Orleans for its 15th annual convention to blast the Eisenhower administration and to chart new goals for federal-subsidized power. The group also took a look at the status of atomic power development.

APPA had on hand several of the outstanding proponents of the federal power cause. These included Sen Wayne Morse (D-Ore.), Sen Lister Hill (D-Ala.), and Leland Olds, former chairman of the Federal Power Commission.

Senator Morse blasted the Administration for its "negative action" in power development. He declared that it "has had no plan for power and expansion except to block and veto the best multipurpose developments available."

Morse Hits Atomic Program

Besides attacking the Eisenhower program as "negative and wasteful" at Hells Canyon and the Columbia Basin, Morse charged that: "Failure to erect affirmative goals in the field of resource development is its negative record in the field of power development from atomic energy."

Morse's solution is construction of a large dual-purpose reactor at the Atomic Energy Commission's Hanford (Wash.) Works and an overhaul of the Atomic Energy Act of 1954. This latter action, said Morse, should aim to "recapture this program for the people—to reinstate the goals of peaceful uses, and to provide a plan of experimental reactors to start us moving toward the goal."

Senator Hill commemorated the 25th anniversary of the founding of TVA, and of his own role as a cosponsor of the legislation which created it.

Noting "the unceasing fight against TVA," Hill declared: "The private utilities hate TVA because TVA is a yardstick against which the people in all the States can measure excessive rates and monopolistic practices. TVA stands as a perpetual challenge to the utilities. It is an argument they cannot answer. Consequently they would destroy it. They will never cease their attacks. This generation and the next and the next must stand mobilized and alert. We can never take for granted this great engine for democracy."

A special session on power supply and legislation was offered by Leland Olds and Joseph Swidler, former general counsel of TVA.

Swidler declared that "for public power systems, the only right policy is the policy of low rates and high use." He warned that high rates "create territorial encroachment problems" and that "many municipal systems are captive markets for the private utilities."

Swidler, citing the number of municipal systems on the wane, said that 6% of those doing business in 1945 went out of existence by 1955. To have a secure future, he stated, municipal systems "must find a way to build their loads to the point where their own generating plants become feasible, and that placing their operations on a public service basis will help them to win community support for establishing their own generating sources—or better yet, for joining forces with other public systems to set up giant central power stations and integrated transmission networks."

Once the municipal systems have decided the policies upon which municipal power operations in the state should be based, Swidler continued, "they reach the question how state legislation can help them in putting these policies into effect." He advised that "of course, they need not wait for new legislation to make a start."

He suggested that a municipality that wants to put its house in order can go a long way under existing statutes. In addition, it will need legislation such as flexible financing authority and an administrative setup conducive to businesslike and non-political operation. He warned that "where power company lobbies are active and effective, it may be unwise to open up the existing municipal electric plant legislation in the state to possible restrictive amendments."

A comprehensive bill for municipal electric operations, Swidler said, should embrace four points: Low promotional rates, authority to issue revenue bonds, definition of financial relationships between the electric system and municipal government, and freedom from the general municipal administration.

Olds Sees Dual Threat

Olds said that federal and state legislation could solve the dual threat which he saw as a challenge to the American system. His dual threat was Soviet superiority in the power field and "domination of our democracy by a giant private power colossus."

His legislative approach would be a compromise between placing the initiative and ownership of "the giant power of the future" in the hands of power companies or of the federal government. He called for federal and state legislation along the following lines:

1. Set up a Federal Electric Power Supply Commission to pre-

APPA Meet

pare and keep up to date long-range surveys of the country's power needs and plans for meeting those needs at the lowest feasible costs. This body would also coordinate the activities of regional federal wholesale power supply grids.

2. Set up eight regional federal wholesale power supply corporations. Each would have its transmission system; would coordinate generation planning; would arrange pooling of all economical generating capacity, regardless of the owner; would handle river-basin programs; would finance and build needed thermal generating capacity where no other utility offered to do so.

3. Permit "private financing of giant power generating stations, integrated by the federal grids, on a high bond ratio basis."

4. Join municipal and cooperative systems "to create jointly owned power supply systems for better participation in the proposed giant power program."

KEYNOTE SPEAKER, Sen Wayne Morse (center), is welcomed by Owen W. Hurd, APPA president. Looking on at right is Alex Radin, general manager

PRINCIPAL SPEAKER, Sen. Lister Hill (center), confers with Leland Olds, (left), former FPC chairman, and Joseph C. Swidler, former TVA general counsel

Federal Aid for Atomic Power

V. L. Parsegian, dean of Rensselaer Polytechnic Institute's School of Engineering, told APPA that the greatest immediate need in the atomic power field is "recognition of the principle that such an industry is needed as a major bulwark to our defense system and to our economy in the face of the cold war and world competition." He called for a major revision of the Atomic Power Act of 1954, and a reorganization to separate military from civilian operations.

Parsegian observed that "the power industry will incorporate atomic systems when it can be done without serious financial loss." Until then, he said, the government must assume the excess costs and risks incident to a major power demonstration program.

A government support program to encourage U. S. reactor manufacturers to tap the foreign atomic market was suggested by Dr. Chauncey Starr of North American Aviation, Inc.

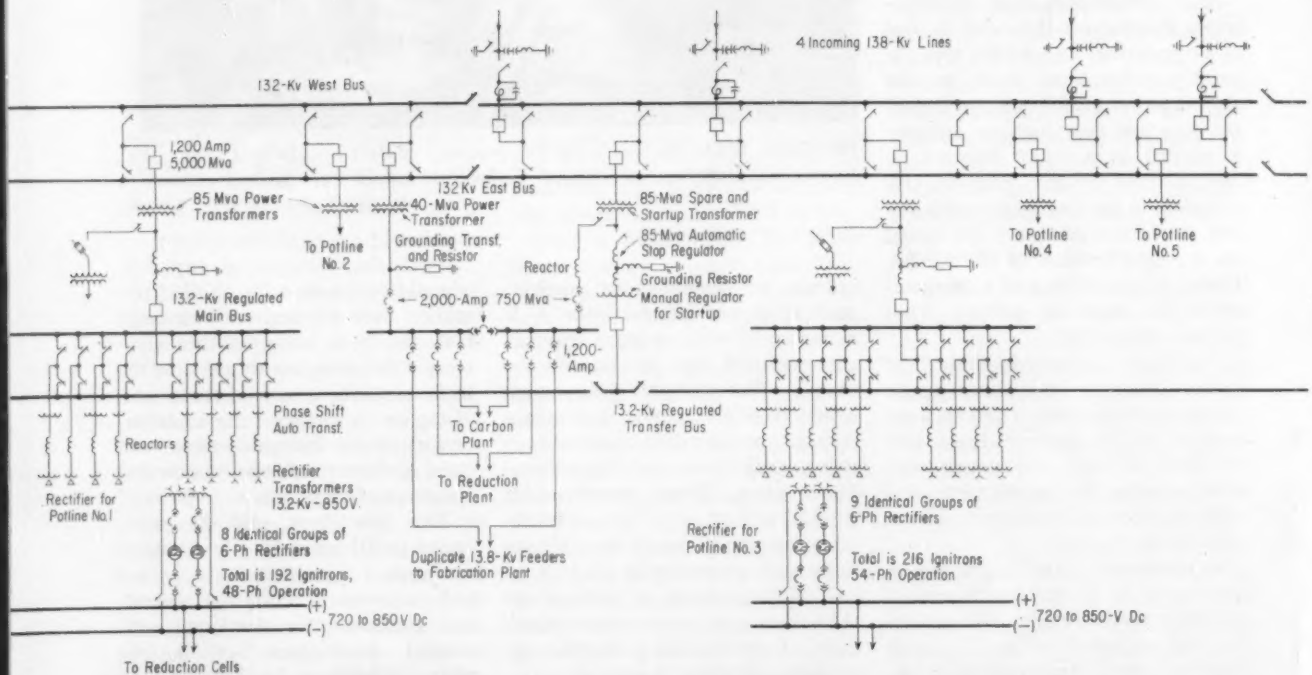
He recommended that foreign utilities be permitted to purchase nuclear power plants from U. S. manufacturers for a price comparable with the cost of conventional plants. The federal government would then make up to the manufacturer the cost difference between the nuclear plant and the conventional plant. These power plants would be part of a series of full-scale prototypes which would have to be built eventually in the U. S. to give us the sequence of technical development and improvement which each of our principal reactor approaches requires, he said.

Dr. Starr estimated that such a foreign support program could be adequately handled for about $160 million over 10 years. He asserted that, far from being another giveaway, "this program would save the U. S. taxpayer a considerable sum of money by virtue of the contribution which the foreign customer will make to the cost of construction and operation of these prototype plants."

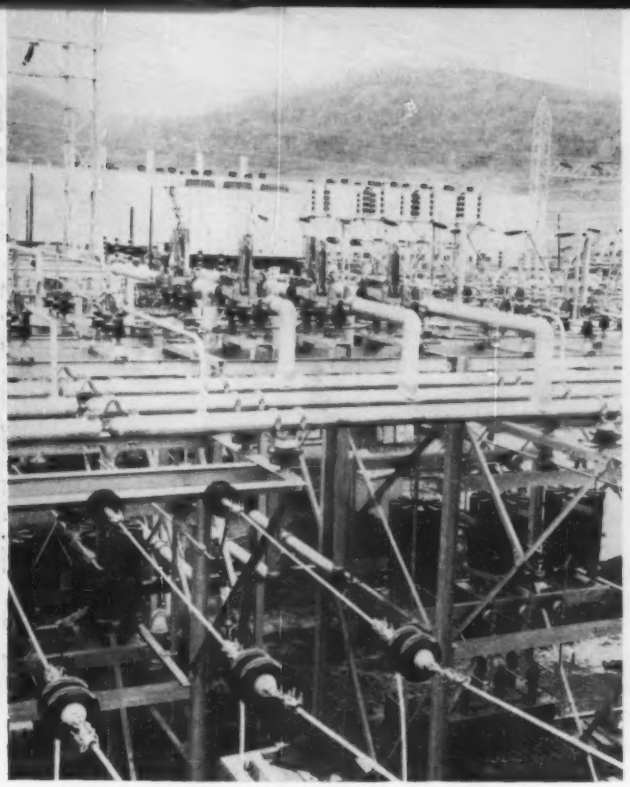
This investment, said Dr. Starr, would in 10 years "firmly establish the nuclear power industry in the U. S., maintain U. S. prestige abroad, and guarantee the continued substantial development of nuclear power technology for not only the U. S. but for the benefit of the world."

Extensive industrial substation spread between the potlines and the rolling mill . . .

New Ohio Valley Aluminum Complex



SPARE 85-MVA TRANSFORMER FIRMS SUPPLY to five potlines and 13.2-kv plant distribution in substation planned for maximum flexibility, reliability. Rectifier connections make separate pulses simulate 96 and 108-phase loading



has 6-in. aluminum-tube bus connection . . .

on 13.2-kv side of 85-Mva transformers

Puts ½ Million Kva on Al Buses

LAWRENCE PAVANE, Project Engineer F. H. McGraw & Company, Engineers & Constructors, New York

Economical conversion and utilization, with a high degree of flexibility and reliability, were the basic requirements of the electrical system for Ormet Corp's* aluminum reduction plant and the adjoining Olin Mathieson Chemical Corp aluminum rolling mill. These facilities and a substation to supply the 465-Mva load are situated on the west bank of the Ohio River downstream from Wheeling, W. Va.

Ormet will produce, upon completion, 180,000 tons per year of primary aluminum. Its first metal was poured late last month. The adjacent Olin Mathieson rolling mill will be capable of handling 120,000 tons a year of aluminum roll products.

Central point of the electrical system is the 330 x 1,148-ft outdoor substation which contains 18 oil circuit breakers and 100 oil-immersed transformers. Four incoming 138-kv circuits terminate on its main and transfer bus. Five 84-Mva 3-phase power transformers, one for each potline, step down to the 13.8-kv buses supplying the rectifiers. A duplicate transformer serves as a spare and startup unit for any potline and double-ends with a separate 40-Mva unit to serve 13.8-kv load in the adjoining carbon plant, cast house, and rolling mill.

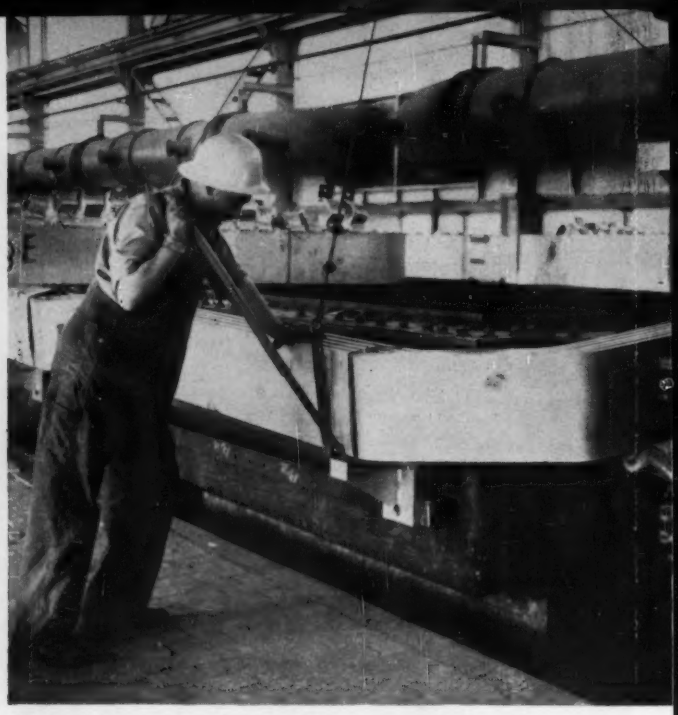
Continuity of service is a prime consideration. For example, a power interruption to a potline long enough to permit the electrolyte and molten aluminum to solidify could keep a line out of operation for several weeks. To safeguard against such a loss it became economically sound to provide several means for overcoming possible emergencies. Three incoming transmission feeders are sufficient to handle the plant load, but a fourth was added as a spare. Therefore, one transmission circuit could go down without curtailing production, and a loss of two circuits would still leave enough power to avoid cooling the pots although output might be curtailed.

The 132-kv system was provided with an east and a west bus so incoming lines and plant loads could be transferred from one to the other for maintenance purposes. Judicious use of sectionalizing switches and a bus-tie breaker permit a high flexibility.

A similar set-up was provided for the 13.8-v regulated buses feeding the rectifier transformers. The normal buses are independent because each potline has its own voltage requirement during operation. But the transfer bus for all potlines is continuous,

*Ormet Corp is owned jointly by Olin Mathieson Chemical Corp and Revere Copper & Brass, Inc. It was formed to construct, own, and operate primary aluminum production facilities for the two firms. Included in this complex are the reduction plant, a power plant in West Virginia, a fleet of barges and a towboat to bring alumina from Louisiana, the alumina plant, and 3 ore ships to transport bauxite from mines in Surinam. F. H. McGraw & Co was prime contractor to engineer and construct the two production facilities.

FITTINGS WELDED TO ALUMINUM TUBING in inert-gas atmosphere make heavy-current joints in 13.2-kv bus runs



PREASSEMBLED SECTION OF DC BUS is eased into place around potline before making up the bolted joints

except for isolating switches, and can be fed from the standby power transformer and regulating autotransformer. Thus, a complete spare supply circuit is ready at a moment's notice should trouble develop on any one of the five normal circuits.

All conductors and buses are aluminum. Bare ACSR from 266.8 to 1,033.5 MCM is stretched between strain insulators for 132-kv circuits. Schedule 40 aluminum alloy tubing up to 6-in. diam, joined by welded fittings and flexible jumpered pin-and-socket expansion joints, is used on bus supports for 13.8 kv. Rectangular sections of aluminum up to 1 x 14 in. are used for the dc bus, 16 bars with 1 in. of space between being used to carry the 85,000 amp required to feed a potline.

Wherever possible, aluminum bus was welded for maximum conductivity by the use of specially constructed welding rigs employing an inert gas atmosphere. Approximately 10 million lb of dc bus was prefabricated off the site and preassembled in maximum lengths before shipment. Where bolted joints were required, ends were sanded, coated and wrapped in plastic bags to prevent oxidation. In the field these joints were wire brushed and connected with high-strength steel bolts and cupped spring washers. Tubular sections were welded in place using plastic sheeting to keep out wind and reduce contamination.

The rectifiers, in a building running the full length of the yard, are arranged to minimize harmonic disturbances by angular displacement of current pulses. Rectifier banks for each of the first two potlines are 48 phase, with one line displaced from the other to simulate 96-phase load. Rectifier banks for the remaining potlines are 54-phase, with angular displacement to simulate 108-phase load. This is accomplished by phase-shifting transformers using zig-zag and star-delta connections.

Output voltage of the rectifiers is regulated to approximately 850 dc by step regulators on the 13.8-kv side of the power transformers. These regulators are remotely controlled either automatically or manually. Each has a delta-connected tertiary to suppress third harmonics and to enable it to function as a grounding transformer for the potline circuit. Individual regulators were specified to avoid increasing the size of the main transformers, thus making repairs more convenient and economical. An additional autotransformer and manual tap changer on the spare circuit provides dc down to 130 v for starting potlines.

The 13.8-kv plant distribution system features dual feeders to each substation. In critical areas they supply double-ended stations for maximum reliability. In other areas not considered as critical, they feed single-ended stations having primary selector switches. The dual feeders are run in an underground duct system having separate manholes for each circuit. Thus, a manhole fault would affect only one feeder.

Large motors in the rolling mill, such as the 7,000-hp synchronous motor which drives the M-G set for the 4-high mill, are powered at 13.8 kv. Smaller motors upwards of 250-hp are generally served at 4.16 kv while 480 v is used for all motors below 250-hp. The 480-v unit substations are Y-connected to provide a neutral for the lighting system which utilizes 265-v lamps so that further transformations are unneccessary.

The main substation is arranged to facilitate maintenance. Depressed railroad tracks extend the full length, one between the phase-shifting and rectifier transformers, and another between power and regulating transformers. Transformers have wheels resting on rails set at right angles to the track: thus they can be rolled onto a transfer car brought down the track to align with the unit's rails and taken away for repairs.

CEA Probes Explosion at Uskmouth

Traces piston seizure to never - before - encountered corrosion mechanism due to salt solution in oil lines

GENERAL VIEW of damage to turbine-generator at recently commissioned plant shows extent of disintegration and scattering of debris. Two men were killed

A corrosion mechanism never before encountered wrecked the 60-Mw turbine-generator at England's Uskmouth Power Station January 18, 1956, the Central Electricity Authority just announced. This mechanism induced piston seizure into the turbine-generator's control systems, the CEA told the Institution of Mechanical Engineers. It gave details of its investigation.

According to the CEA's report, the disaster was initiated by the accidental tripping of the main exciter. The steam valves remained substantially open for an estimated 13 sec after load rejection and caused a turbine overspeed condition of 70% (5,000 rpm). The low-pressure turbine, its shaft, and the generator rotor disintegrated, and debris was scattered over a wide area, killing two people and injuring nine. The plant had only recently been commissioned.

As explanations of the nature and sequence of the failure involved many inconsistencies, a large investigating committee, including many experts from government research laboratories, was recruited. The investigation established that a dilute solution of salt present in the oil system through sea-water leakage had attacked the pipework and caused the deposition of finely divided pure magnetite on the piston, cylinders, and valves in the control mechanisms. The reciprocating motion of the mechanical components compacted the particles into an extremely hard interference film.

Interference was enough to prevent the oil-release valves from rising when all trips associated with the control governor and the overspeed governor had been thrown. The valves moved only when excited by vibration of the plant just before it broke up.

Survivors' accounts and the findings of a preliminary survey proved confusing. Evidence implied that serious overspeeding has not occurred, and that the protective systems had functioned properly. Trip circuits, turbine emergency valves, and relays were all found to be in order. Such damage as there was to the governing and protection systems appeared to have been caused during breakup. Very little steam had escaped.

Iron Oxide Discovered

Metallurgical examination of the debris ruled out defective materials and established extensive overspeeding. These facts, together with the known condition that the steam valve solenoid had been fully energized, pointed to seizure in control valves and relays.

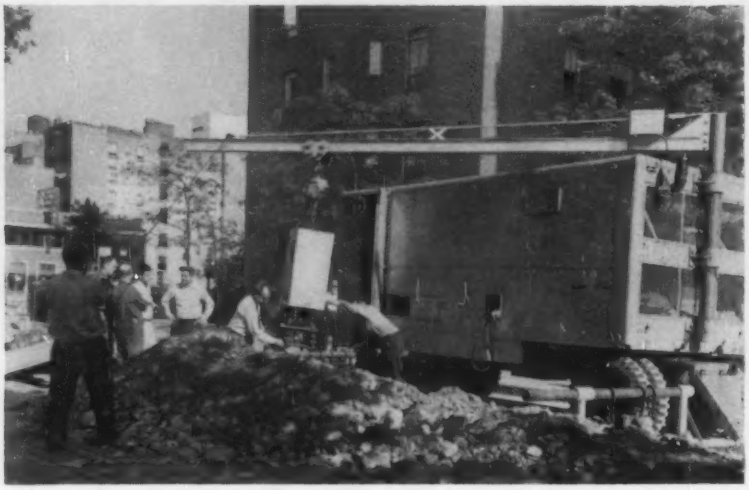
Ovality, leading to slight piston interference in at least one power cylinder, had been discovered earlier. But as this cylinder had been broken during the breakup, this distortion was considered as due to a release of internal stress during fragmentation. A more severe test revealed that the ovality was caused by deposit of an extremely hard, black iron oxide about 0.001 in. thick.

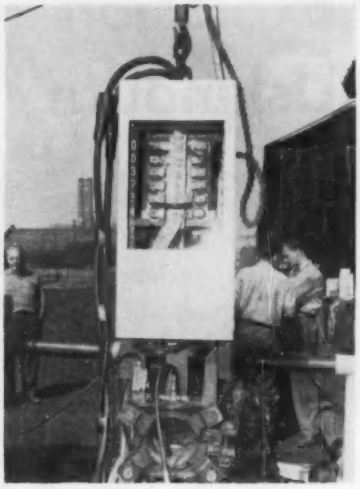
X-ray diffraction techniques and an electron microscope showed the film to consist of minute particles of pure magnetite (Fe_3O_4), averagaing 0.05 microns.

Tests showed that the only possible reagent which could lead to the presence of such finely divided magnetite in the oil system was a dilute solution of sodium chloride. Accordingly, it was assumed that estuarine water had leaked into the oil cooling system. Furthermore, it was established that the pipe metal-saline reaction only proceeded in the presence of free oxygen and would not have occurred were the system running full.

Since the unit's commissioning, the control and lubricating system had been drained several times during shutdown. Such draining left pools of oil which formed corrosion cells throughout the pipework where there were the necessary air-liquid metal interfaces. Recharging the oil system produced a deposition of the magnetite in the piston and valve recesses. The final link in the disaster chain proved to be a compaction mechanism induced by the slight reciprocation motion of the valves and pistons.

Butt Weld Steel Pipe Faster in the Field





Modified Sprockets Cut Costs $1,500

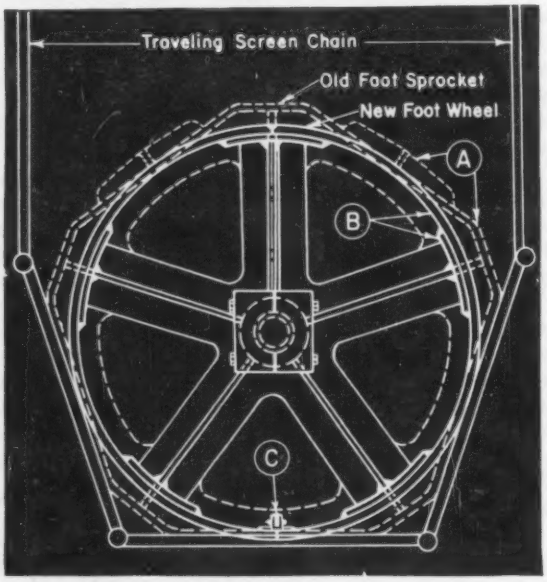
W. E. ADAMS, Mechanical Maintenance Foreman, Windsor Plant, Beech Bottom Power Co, Power, W. Va.

Modification of the lower sprockets of ten traveling screens for circulating water has eliminated repeated breakage of drive gear and chains, resulting in annual savings of $1,500 in reduced maintenance.

Formerly, these sprockets had five flat sides and protruding lugs which would not properly engage with the chains when they developed a slight slack due to pin and bushing wear. Then the chains would bind or break and even damage the drive gear. During a normal year, six to eight broken drive gears or chains could be expected, depending on water conditions, chain speed, and operating hours. Repairs were costly and time-consuming because the lower sprockets are submerged 66 ft below the drive sprockets.

To eliminate this trouble, the five flat sides and lugs were cut from each of the lower sprockets and replaced by a band rim (5-in. wide by ⅝-in. thick) backed at the end of each sprocket arm by a strip of the same material. These modifications are illustrated. Electric welding was practicable because all-steel sprockets were used.

These drum-type wheels eliminate the necessity of the chain links meshing with any lugs or flat surfaces. Now the chains can slide around these drums if they or their shafts bind from any cause whatever.



MODIFIED WHEEL is shown by solid lines, original sprocket by dashed lines. (A) represents old flat surfaces and lugs which were removed; (B) present rim with backing strips; (C) consists of 2-in. angles welded to join ends of the rim

Based on current labor and material costs, this modification would now cost $1,500 for the ten screens. Close to 87% of the expense would be for labor and 13% for materials. However, it is estimated that this initial revision expense is saving $1,500 per year.

A new process for butt welding steel pipe in the field holds promise of making 10 welds an hour—almost a 1,000% improvement over conventional methods. This process, developed by Consolidated Edison Co, with the assistance of New Rochelle Tool Corp, utilizes induced high-frequency current in combination with controlled pressure, torsion and vibration.

The process permits a weld to be made on pipe up to 14-in. diam in about 1½ min, compared with the average butt welding time of an hour. Con Edison hopes to keep the welder in place and move the pipe to it, to achieve an estimated 10 welds per hr on a long run. However, even if the apparatus must be moved, an estimated four welds can be made in an hour—still four times as many as by conventional methods.

The New Rochelle Tool Corp was asked by Con Edison to provide high-frequency equipment suitable for butt welding of steel pipe. Con Edison designed and developed the line-up and pressure-producing hydraulically controlled jigs for handling the pipe materials. The equipment is mounted on a mobile unit adapted by Con Edison for easy welding in a trench or on the ground in congested streets. A high-frequency generator, Diesel motor, and control equipment are assembled on a 7½-ton trailer which has an 18-ft boom carrying an output transformer, work coil, pipe alignment jig, and hydraulic clamps.

The 100-kw, single-phase, 10-kc generator is driven by a Diesel unit; both are water cooled. The control cabinet contains meters, timers, capacitors, and protective devices which match output to pipe size. The work coil and pipe load are matched to the generator by a water-cooled output-transformer capacitor bank.

The clamps, attached to the pipe sections, exert 2,000 to 4,000 psi, depending on wall thickness. Argon gas sprayed around the weld creates an inert atmosphere around the butt edges. The current is shut off automatically when the weld is completed.

Induction welding, says Con Edison, produces a sound weld with characteristics ideal for pipe line joints. The build-up of metal occurs outside, while the internal diameter remains full size. No flash or slag must be removed, and no extraneous metals are introduced to alter basic characteristics of the steel.

Brackets Cut Cluster-Mounting Cost

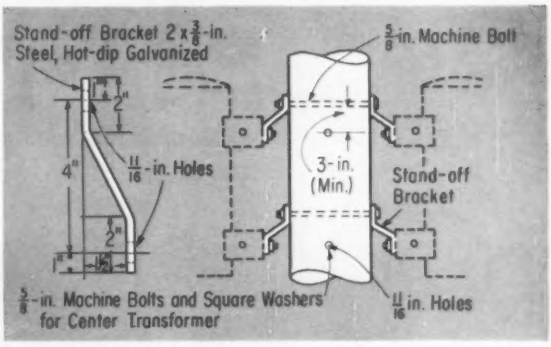
J. S. SUTPHIN, Area Supervisor,

C. B. SHARPE, Working Foreman, Appalachian Power Co, Marion, Va.

Three-phase banks of up to 25-kva transformers may be cluster-mounted on steel stand-off brackets attached directly to the pole. This scheme used by Appalachian Power Co for cover-bushing transformers only, provides significant savings over former methods. It also reduced the overturning moment on the pole.

The stand-off bracket was developed by Joslyn Mfg and Supply Co at the request of American Electric Power Service Corp. Details of the bracket, and how four are used to mount two of the three transformers, are shown in the accompanying drawing. The third transformer mounts directly on the pole. Holes for the bolts are located so as not to jeopardize the pole's strength.

Cost of the basic mounting on 8-in. diameter poles breaks down to $3.37 for four brackets, $1.07 for four ⅝x10-in. machine bolts, and $0.14 for two 2¼-in. square washers. Total cost of $4.58 is as much as $26.64 below the cost of using six-pin double arms with a kicker and hangers, and $10.20 below the cost of the lowest-price frame for cluster-mounting investigated. Time and labor of installing transformers directly on poles with brackets obviously will be less than when arms or frames are used. Though climbing space with transformers cluster-mounted in this fashion is somewhat restricted, clearances meet with NESC standards



so long as cover-bushing transformers are at least 40 in. from primary conductors.

Prior to the use of the brackets, a trial installation was made using halves of 3-bolt guy clamps to hang two of the three transformers in the cluster. Each of these two were hung at the ends of two ⅝-in. double-arm bolts through the pole. To test the mechanical stability of these underhung transformers, the pole supporting them was jarred severely. There was no swinging or swaying of the units.

As compared with use of guy-clamp halves, brackets simplify installation in that there is more clearance for transformer mounting bolts, and machine bolts rather than double-arm bolts can be used. Also, less square washers are needed.

Sighting Method Is Best For Sagging

Visual method most direct, fastest for wire over 500 MCM, but other methods serve for medium, smaller wire sizes

PHILIP C. EVANS, Project Supervisor, B. C. Engineering Co, Ltd., Vancouver, B. C.

For sagging heavy wire (ACSR upwards of 500 MCM), the visual sighting method is most direct, fastest, and gives the most satisfactory results. Correct sagging gives the proper ground clearance under extreme loading conditions, such as under the weight of ice, and limits tension to a value below the maximum for structure design. Medium and small sizes may be sagged by two other methods:

1. Tension may be measured directly at point-of-pull by a dynameter or similar device. But this method is unsuitable for long sections, as sheave friction causes tension and sag to vary from span to span. Moreover, the dynameter is difficult to keep in adjustment, so that there is the risk of overstressing both the wire and structures. This difficulty is more pronounced with heavy wire.

2. There is also the stopwatch method. This instrument measures the time for a vibratory wave to make a certain number of reflected returns, the wave having been set up by striking the wire at one end of a selected control span. Time of return is a function of wire tension and, when it has been determined, both tension and sag may be read from the proper curves. Useful on small and medium conductors, this method affords only a rough check on heavy wire.

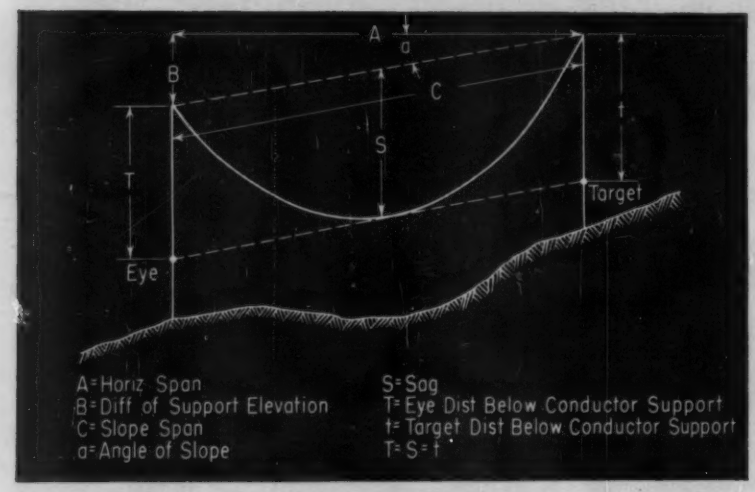


FIG 1—DIRECT TARGET METHOD of sagging conductor involves taking a sight from the adjacent structure at an equal distance below the corresponding support

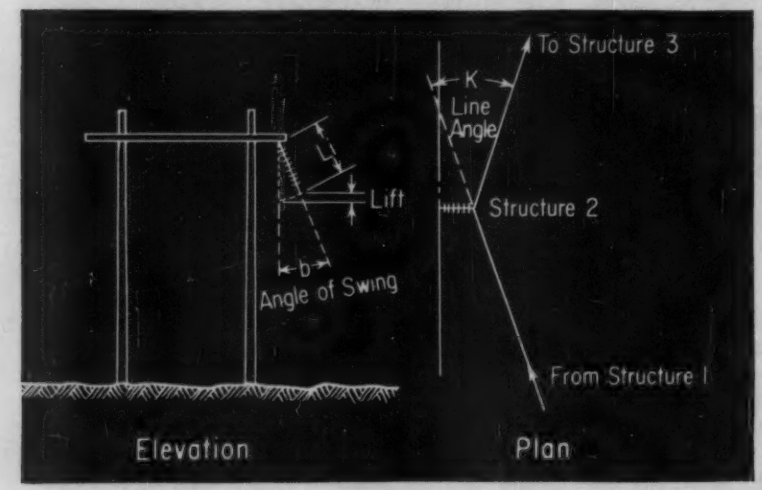


FIG 2—AT LINE ANGLE the insulator string swings from the vertical under sagging tension, lifting the conductor support. Allow for lift's exact value

Allows for Sheave Friction

Measuring the sag of two spans makes allowance for sheave friction and error in target measurement, or in sighting. When only two are used, they should be near the ends of the section. In a rough or twisting section, one or more intermediate spans should be used as well. Sag must be checked on both sides of a sharp break in either profile or plan, including angle points over 10 deg.

Longer ones are usually selected for control spans. When these are sagged precisely, the shorter spans fall in line, giving the conductor a uniform appearance. When control-span length varies considerably from the section's ruling span, error may arise as sag tables and curves often are based on a parabolic relationship which only approximates the catenary.

The effect of using a control span longer than the ruling span, however, can be balanced by choosing a shorter one as a secondary control. An approximately correct tension for the section is obtained by splitting the sighting difference. Control spans not exceeding 15% grade serve best.

There are three common ways of sagging by eye. The direct-target method sets a target at a distance equal to the desired sag below the conductor support on one structure.

Big ACSR

A sight is taken from the adjacent structure at an equal distance below the corresponding support (Fig 1). In an inclined span, sag is obtained by entering sag table or curve with "equivalent", rather than horizontal span. Equivalent span equals

$A + B^2/A$, for deadend spans
$A + B^2/4A$, for suspension spans

where A is horizontal span and B the difference of support elevations.

At a line angle, the insulator string swings from the vertical under sagging tension, lifting the conductor support (Fig 2). The exact value of this lift should be allowed for:

$$\text{Lift} = L_i - L_i (\cos b)$$

$$\text{and } b = \tan^{-1}\left(\frac{2T_h \sin \frac{k}{2}}{(VWc) + Wi/2}\right)$$

where

L_i = length of insulator string, ft.
b = angle of insulator swing from vertical
T_h = horizontal tension in the sheaves, lb
k = line angle
V = effective vertical span, ft
W_c = conductor weight, lb per ft
W_i = insulator string weight, including hardware, lb

A structure's effective vertical span (Fig 3), scaled from the profile, measures wire length of adjacent spans supported at that structure. In steeply inclined spans, components of weight on one side of a structure may be negative.

Temperature Considered

It is customary to locate the target and sighting point for a sag corresponding to the anticipated sagging temperature. If the temperature varies during sighting, it is permissible to allow for sag variation by moving the sighting point up or down a distance equal to double the sag increment.

A bracket-mounted transit often facilitates sighting and provides a horizontal cross-hair for leveling the conductors against the target.

When it is not practicable to sight from a point at an exact distance below the conductor support, or it is desirable to sight through a tripod-mounted transit from the structure base, the computed target method is useful (Fig 4). A sighting point is chosen at a convenient distance, T, below the conductor support on one structure, and a distance, t, for locating the target on the adjacent structure is computed:

$$t = 4S - 4\sqrt{ST} + T$$

At least two values of t should be computed for values of S corresponding to different sagging temperatures. If two targets then are set, it is easy to interpolate visually for intermediate temperatures.

Here, also, allowance must be made for insulator swing if there is a line angle at either structure. If the angle is at the sighting structure, the lift correction obtained is applied to T before calculating t. If the angle is at the target structure, correction is applied to t before setting target. This method has limitations. If T varies greatly from S, line of sight becomes tangent to the wire at a point too far from maximum ordinate of the catenary, and a basic error, aggravated in steep spans, will arise. A limiting relationship is useful:

$$3/4\,S < T < 4/3\,S$$

If T does not fall within these

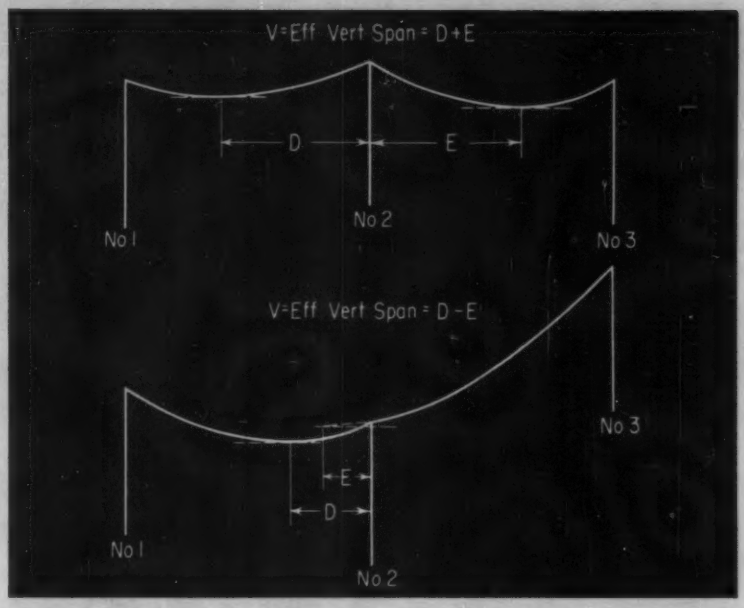


FIG 3—EFFECTIVE VERTICAL SPAN of structure, scaled from the profile, measures wire length to adjacent spans supported at that structure, as is illustrated

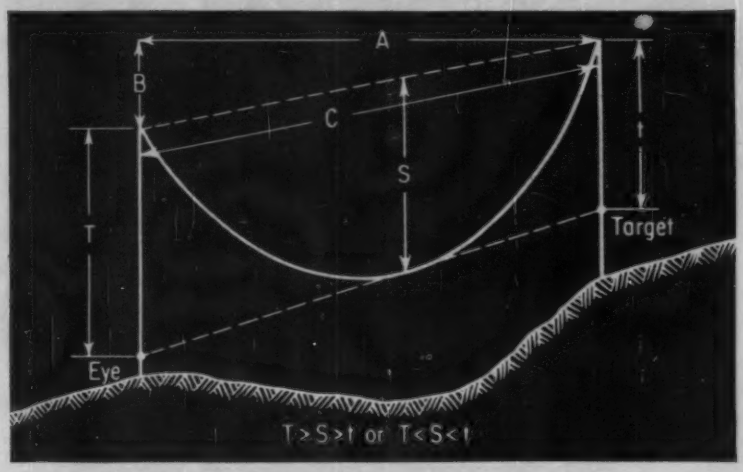


FIG 4—COMPUTED TARGET METHOD proves useful when sighting from point exact distance below support is impracticable, or by transit from structure's base

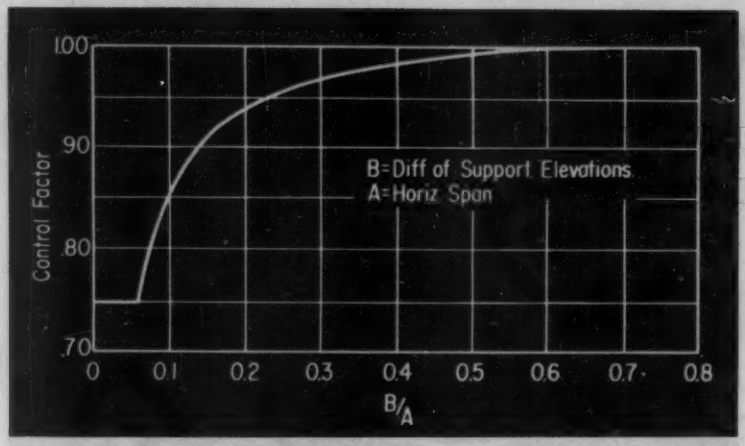


FIG 5—CONTROL FACTOR should exceed minimum value expressed in curve. It's a function of quotient of support elevations' difference/horizontal span

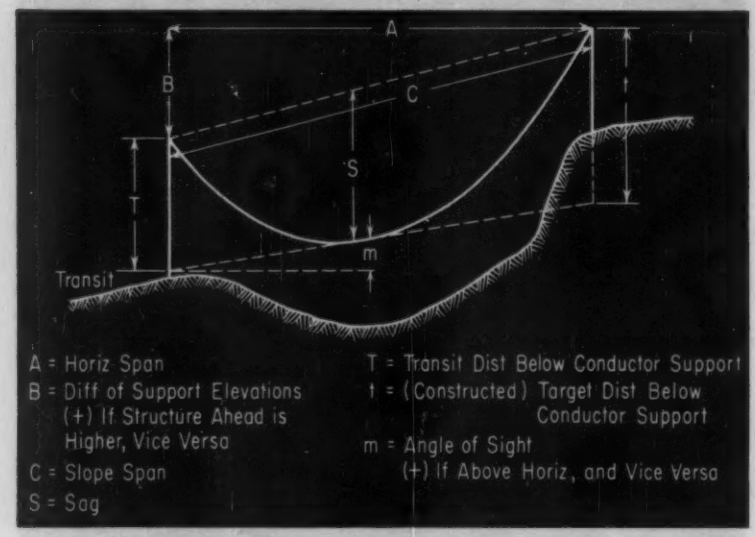

A
B
C
S
T
t
m
Transit
A = Horiz Span
B = Diff of Support Elevations (+) If Structure Ahead is Higher, Vice Versa
C = Slope Span
S = Sag
T = Transit Dist Below Conductor Support
t = (Constructed) Target Dist Below Conductor Support
m = Angle of Sight (+) If Above Horiz, and Vice Versa

FIG 6—VERTICAL ANGLE METHOD is used for a long span where sag is large compared to structure height and the target falls below the base of the structure

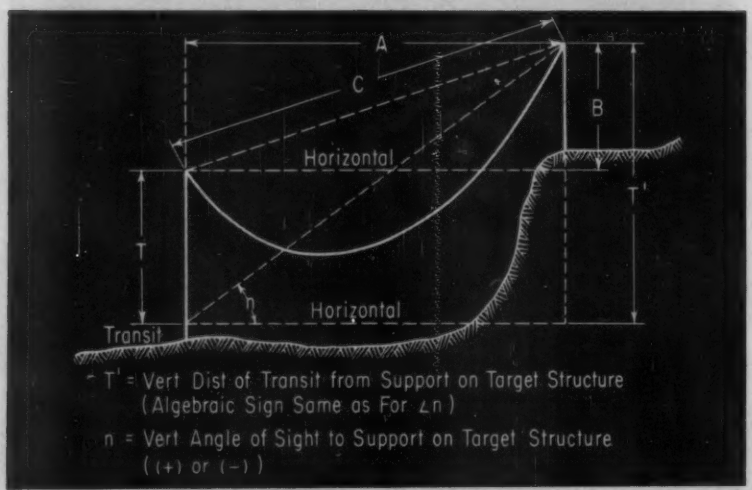


FIG 7—TRANSIT SHOT should be used to determine the difference of support elevations precisely by simple triangulation before computation of vertical angle

limits, a control factor should be computed:

$$CF = 1 - \left(\frac{T - t}{4S}\right)^2$$

The control factor should exceed the minimum value allowed by Fig 5. If the control factor fails to satisfy the minimum value and it is not possible to select a better value of T, it is best to choose another control span.

In a long span, where sag is large compared to structure height, the target may fall below the base of the structure. Here the vertical angle method (Fig 6) may be used. A sighting point at a convenient distance, T, below the conductor support on one structure is chosen. A vertical angle of sight is computed, and the transit is set at this angle above or below the horizontal. Angle m is obtained by simple geometry it t has already been obtained:

$$m = \tan^{-1}\frac{T + B - t}{A}$$

Also in this method, requirements of a limiting control factor should be met by computing t before computing m.

Again two values of t and m are obtained for two different temperatures, allowing interpolation for intermediate values of the angle corresponding to other temperatures.

Value Must Be Precise

A precise value of B must be used. This cannot be scaled off the profile with sufficient accuracy. A transit shot should be used to determine B precisely by simple triangulation, before computing the vertical angle (Fig 7). It will be apparent that in every case

$$B = A \tan n - T$$

whence

$$\tan m = \frac{A \tan n - t}{A}$$

Close attention must be paid to the algebraic signs of n and m.

A prime essential for safe and successful sagging is a positive and dependable system of communications, linking the power winch, the various control spans, and the snubbing points.

With more than one control span, work should be performed progressively forward from the rearmost control span, bringing each span in turn into correct sag. In long sec-

(*Continued on page* 96)

S-1 meter socket EARNS UTILITY ACCEPTANCE

Chances are you're using General Electric S-1 square sockets on your meter installations right now . . . for the S-1 has been placed on acceptance lists by more utilities *throughout the country* than any other socket in its class.

Reason: it has the high quality that today's improved meters demand of a socket . . . quality that protects your meter investment by helping to sustain accuracy and performance throughout the long life of the meter.

In the dependable S-1 socket, you'll find the combination of features meter men look for . . . versatile mounting, positive grounding with either lay-in bus-type or serrated-strap grounding terminals, and pre-scored knockouts. Attractive design, too, plus full 100-amp capacity and plenty of room inside for quick, easy wiring and installation. It's made of rugged, lightweight aluminum that's weathertight and corrosion-resistant.

No wonder so many utilities are switching to the S-1 . . . industry's *only* quality square socket manufactured right beside quality meters. Ask your General Electric Apparatus salesman. He'll show you more reasons why the S-1 is the most popular square meter socket in its class. Or, write to General Electric Co., Section 628-12, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Tree-Trimming Costs Reduced

C. CLYDE CROCKETT, Transportation Supt, Louisiana Power & Light Co, New Orleans, La.

Furnishing a ten-man team with six pieces of mobile equipment and pneumatic tools saves the Northern Division of Louisiana Power & Light Co about $20,000 a year in tree-trimming costs.

The team, set up in 1954 to obtain better use of trained manpower, operates two standard ladder trucks, two booms on 2-ton trucks, two trimmers, a chipper, and an assortment of pneumatic tools. There is also a pickup truck for the foreman.

The pneumatic tools consist of two large tree pruners, a chain saw, and a reciprocating saw with a 7-ft extension. These are operated from air outlets at both the top and bottom of the booms and ladders, the air being supplied by compressors driven by auxiliary engines on three trucks. The compressor on the fourth truck, an older one, is driven by the main engine. Experience has proved the auxiliary engine better than a power takeoff.

LADDER TRUCK is used mainly in rural areas where trees to be trimmed are far apart and brush can be dispersed

CHIPPER has water tank and tools on the side of dump body located behind the chipper mechanism

AERIAL BOOM has foot controls in the basket and a pedestal that is insulated from truck to provide greater safety

Boom Truck Has Two Men

The mobile chipper unit has a chipper capable of reducing a 4-in. tree limb. It is mounted between the cab and steel-box dump body on a 2-ton truck and gets its power from a reversible, split-shaft power takeoff connected behind the transmission. The transmission transmits full engine horsepower, permits the use of the parking brake to stop the chipper and to bring it to speed, and the use of the truck speedometer as a chipper tachometer (37 mph equals 2,550 rpm.

Chips from the chipper are channeled in a duct to the left top front corner of the steel-box dump body, where they bounce off a deflector plate over the top of the corner. The plate is shaped to distribute the chips evenly around the box, obviating manual spreading. The chipper unit carries a leaf rake, broom, fork, axe, and gasoline-engine-driven chain saw, as well as an assortment of smaller tools hung on the curb-side of the dump body. A water tank holds 40 to 45 gal of water for washing away dirt and grime. One man handles the chipper unit.

Two men are assigned to each boom truck, and where considerable trimming is involved both trucks are operated as a unit along with the chipper. At times, a ladder truck is part of such a unit.

Two trimmers rotate about every two hours in operating each boom. While one works the basket, the other pulls hangers out of the trees, trims from the ground, drives the truck, and stacks limbs at the curb, butt ends to the street. Such rotation prevents fatigue. The chipper unit follows the booms, its single operator easily keeping up with them when the brush is properly stacked.

When a ladder truck operates in conjunction with two aerial booms, the chipper unit is used full time eating up the limbs and dumping the chips.

No. 6 in a series

Right off the Wire

A computer-controller system is said to be capable of landing 120 jet planes per hour. Human control can average no better than 40 per hour.

&

Dockside facilities at SIMPLEX' Submarine Cable Division in Newington, N. H. are extensive enough to continuously load two of the largest submarine cable ships simultaneously.

&

A new plant is reported to cut the manufacturing time of industrial carbon components from eight weeks to eight minutes.

&

A "building block" technique, using miniature plug-in units, makes it possible to build an electronic computer small enough to go on an office desk.

&

An iron-aluminum alloy has been made, the behavior of which indicates that there is a relationship between rusting and magnetism.

&

Some fruit trees have been found to ripen earlier after long exposure to gamma radiation.

&

At least one of the new "exotic" rocket fuels is being made in solid form and others are expected soon.

&

A patent has been issued for a radioactive "go-devil" (a device for cleaning pipe lines). If it sticks in a pipe it can be located with a Geiger counter.

&

It is estimated that malicious damage to street lamps costs New York City a quarter of a million dollars a year. A new plexiglas globe makes this sort of vandalism almost impossible.

&

Instead of the usual bracing and shoring, inflatable cushions are being used to wedge freight tightly in box cars.

One of the new guided missiles is launched from an automatic base which computes the location of the attacking object, calculates its speed and the proper point for meeting it. It also loads and fires the missile automatically.

&

A micro-porous synthetic material holds a liquid, such as an ink or lubricant, and gives it off at a controlled rate.

&

Damage to small delicate parts on a conveyor can be avoided by a new belt that uses permanent magnets to hold the pieces apart.

&

Glass-reinforced plastics can be strengthened by the use of a special new glass containing copper oxide.

&

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

&

A new wool-like synthetic fiber is water-repellent, quick-drying and less expensive than other synthetics.

&

A device for measuring the power output of a turbine involves an inner and an outer gear in constant mesh with free space between the teeth. This space is filled with oil on which the pressure can be measured.

&

Simplex Wire & Cable Co. was the first to adapt interlocked armor (CONDEX) for use with underground cable in 1924.

&

A logging company is using plastic nails to fasten logs together. They neither rust nor damage saw blades.

&

Paralyzed fingers can be made to move by means of tiny artificial muscles powered by a carbon dioxide cartridge.

Research conducted by two Simplex scientists in the early 1920's resulted in the first truly moisture-resistant rubber insulation. The isolation and removal of the proteins that are always present in natural rubber was the basis of the now famous ANHYDREX family of insulations.

&

Foamed aluminum is being made for use as a core in sandwich construction.

&

An electronic device checks the accuracy of aircraft guns without firing them.

&

Rooftop Laboratory

These cable samples, twisted and bent to exert maximum stress on insulations and jackets, are undergoing sun-crack endurance tests atop the Simplex plant at Cambridge. Many of these samples have been exposed to the elements for as long as fifteen years . . . and they haven't cracked yet. This is one example of the many punishing tests which Simplex insulating and jacketing compounds, such as Anhydrex, Thermoplex and polyethylene, are subjected to before they win final approval.

It's all part of a comprehensive system of quality control which has helped make Simplex the leader in cable research and manufacture.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

Highest quality cables for: Mining
Power & Lighting • Construction
Transportation • Communications
Signalling

"The American manufacturers of transoceanic telephone cables"

W. H. Fisher, California Oregon Power Co., chairman, Electrical Equipment Committee; J. V. Kresser, Westinghouse; Dr. Pier Abetti, General Electric; R. P. Martell, Puget Sound P&L Co, chairman, Engineering & Operations Section

Says Utilities Lag on Research

McKee of PP&L urges NELPA meeting to ready Northwest for eventual swing from hydro to nuclear, thermal power

Electric utilities are not carrying 10% of the research they should, as an industry or as individual companies. This indictment was delivered to the Northwest Electric Light & Power Association's annual Engineering & Operation Section meeting in Yakima, Wash., recently by Paul B. McKee, Pacific Power & Light Co.

The Pacific Northwest soon must turn to nuclear and thermal power, McKee warned. And with this change from hydro will come tremendous opportunities for engineers who must be backed by adequate research.

Preach research, McKee urged utilities. Convince regulatory bodies you must have leeway in rates to finance research beyond fish studies, nuclear energy programs, and computer applications.

Utilities eventually will move toward flat demand rates to recognize cost of service rather than fuel, predicted J. M. Wallace, Westinghouse Electric Corp. Assuming that fuel costs eventually would be negligible compared to fixed investment, depreciation, and service charges, the flat demand rate would closely follow actual power system costs, he said.

But the public has been told that fuel, not service availability, is the predominant cost factor, so that extensive education is needed. Wallace cited telephone companies' essentially flat rate.

Transformer design by computer is being rapidly accepted by General Electric Co engineers. Excellent experience since 1954 with a CPC digital computer, delivering preliminary designs, spurred GE to install a high-speed IBM-705 system, said Dr. P. Abetti. The 705 gives full and final data to the drafting department on 10 to 50 Mva transformers of standardized mechanical designs. But many electrical modifications can be handled, Abetti noted. Typically, a complete reactance calculation costing $300 and 60 manual man-hours can be completed by machine in 57 sec for about $5.

Cites Computer Uses

Utility engineers applying digital computers justified for accounting often work unusual hours to obtain access to the machine, said Dr. J. B. Ward, Pacific Power. But good liaison and cooperation between engineering and accounting users can ease much inconvenience. Greatest gains in computer use accrue from efforts to accelerate convergence of iterative calculations on constantly recurring problems, Ward said.

Normalizing system load-trend curves to remove temperature effects permits precise analysis of economic trends. A Portland General Electric Co method uses a 52-week moving-total plot of net system load requirements adjusted to a normal degree-day basis, said J. D. Simons. About 10% of PGE system load is temperature-affected, and that ratio is holding.

Totaling meter-route readings for an area of similar-quality homes, and comparing January totals over several years, assists Washington Water Power Co to establish area growth rates, locate new substations, and expand others. The method's value is greater where primaries are networked, said W. A. Morgan. Checks of the method's demand estimates against experienced peaks shows that load factors can be assumed accurately enough for good estimates.

Sending-end reactors are attractive for stability and voltage control of a generator feeding a long lightly loaded line, said J. V. Kresser, Westinghouse. The reactive sink could go at either end, but at the source it can be compensated directly, so that generator excitation is affected more closely. And sending reactors are fine for line-changing when energizing from the receiving end.

But as a more common effect on long lightly loaded lines is high receiver voltage, natural solution puts the sink at the receiver end for its

(*Continued on page 60*)

From Westinghouse Plowback of Earnings into Research...

FAULT INTERRUPTING CAPACITY FOR TOMORROW'S SUPER-POWER SYSTEMS

Building upon generations of experience in the High Power Lab, Westinghouse engineers have expanded the heavy-fault-interrupting capacities of breakers of 69 kv, 115 kv, 138 kv, 161 kv, 230 kv and 345 kv.

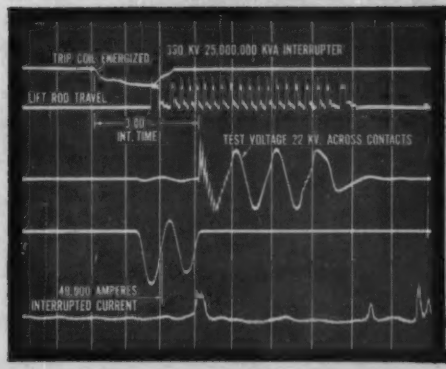
The fundamental techniques of arc deionization developed by Dr. Slepian at Westinghouse led to the present multi-break grid design that brought to the industry circuit breakers with capabilities to interrupt 10-, 15- and 25-million-kva faults. Several well-known cooperative studies have already proved the feasibility of raising system voltages and power concentrations even further.

Westinghouse power circuit breaker designers say that the still higher interrupting capacities needed can be developed with refinements of their basic De-ion® grid. Whatever the industry's requirements in protective equipment to handle the rapidly growing power loads, Westinghouse will continue to provide circuit breakers . . . in advance of their need!

For further information and a copy of the informative Circuit Breaker Handbook, B-7232, call your Westinghouse sales engineer. Or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60061

YOU CAN BE SURE...IF IT'S

Westinghouse



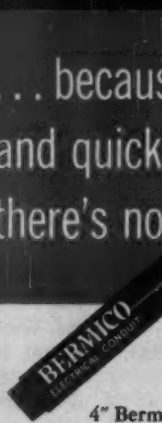
Oscillogram at left is typical of the outstanding performance of Westinghouse circuit breakers in quickly and safely interrupting heavy faults.

One-, two-, three- and four-break grids, at right, provide the maximum interrupting capacities on systems from 69 to 345 kv . . . interrupt faults up to 25,000,000 kva. Interrupter blocks are easily removed for inspection of stationary fingers and moving contacts. Contacts removable without loss of alignment between moving and stationary contacts.

BERMICO® electrical conduit used at Pungo Naval Air Station

. . . because "it's light, strong, easily and quickly installed. Costwise there's no match for it," says M. J. Lehtio,

Branch Manager, Clarke Electric Co., Inc., Norfolk, Va.



Forty thousand feet of 2" and 15,400 feet of 4" Bermico Conduit will carry antenna-lead, power, telephone, teletype and intercommunication cables for the new Coast Guard radio installation at Pungo Naval Air Station, Norfolk, Va.

Bermico Conduit is precision engineered from cellulose fibre impregnated with coal tar pitch. It is uniform in quality, with smooth inside bore allowing easy cable pull-through without danger of abrasion. Highly resistant to acids, alkalies, heat, water and corrosion. Bermico is confidently used by leading electrical contractors on this and other government projects, knowing it surpasses Federal Specification W-C-581 by an ample margin.

On your next job why don't you use Bermico? Immediate shipment of all sizes and fittings guaranteed.

Distributed by **WESTINGHOUSE** Electric Supply Company

Offices in principal cities

BROWN COMPANY

General Sales Offices: 150 Causeway Street, Boston 14, Mass.
Mills: Berlin, N. H.; Corvallis, Ore.

NELPA Meets

(*Continued from page* 58)

more direct voltage control.

Puget Sound Power & Light Co has several live-line selector installations which automatically transfer substations or lines from dead to hot sources by disconnects, reported P. F. Hargreaves. Good experience has been achieved with this scheme on several 110 and 55-kv distribution substations, a 55-kv line serving distribution substations, and a 110-kv line feeding a major switch station, he said.

Use of heavy-duty, 14-kv power-class reclosers to 200-Mva I. C. is finding acceptance for feeder main protection on buses fed by transformers to 7.5 Mva by British Columbia Eiectric Co. These small stations have no high-side OCB, so that no control house, cabling, etc, are necessary, said K. Kidd, B. C. Engineering Co.

Urges Caution

R. C. Safranek, Washington Water Power Co, reported 4 to 5 years good experience on about 40 heavy-duty reclosers on 13-kv regulated feeders, which probably will lead to more installations. Puget Sound also has about 40 in service with favorable results, Hargreaves added. Use of reclosers at many Utah Power & Light Co substations to 3,750 kva was reported by W. E. Clements.

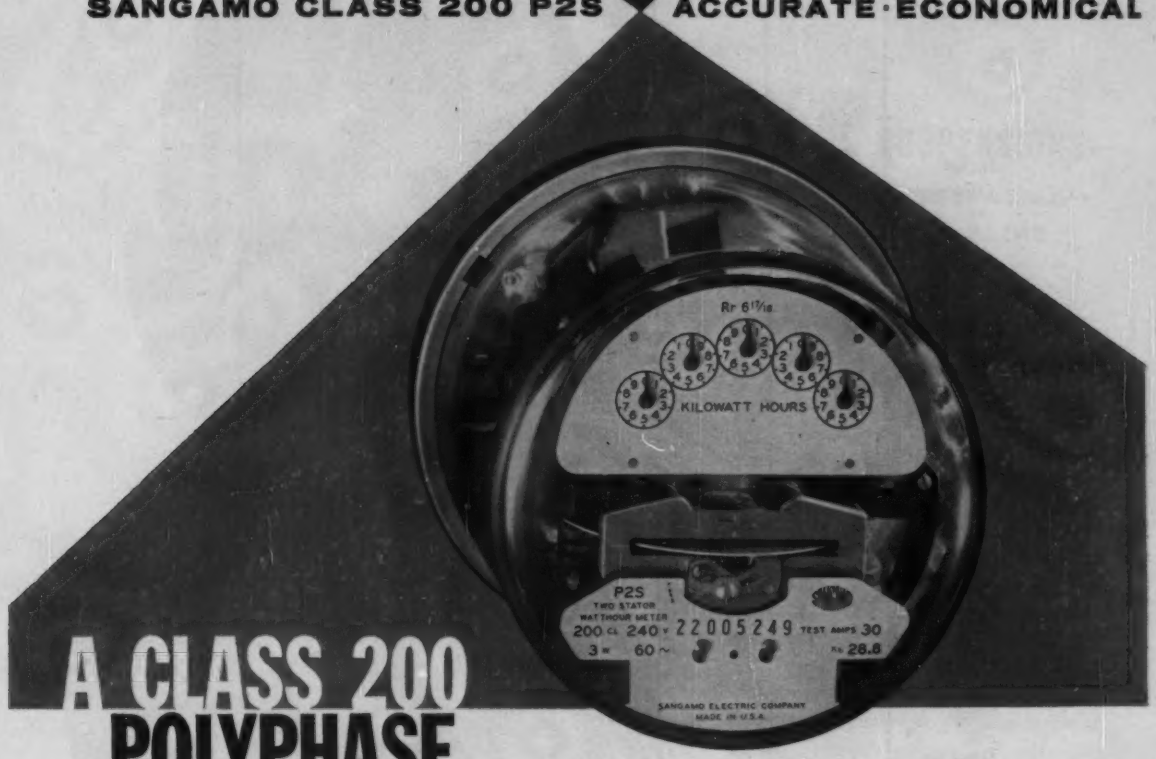
But with OCB cost a small part of the entire station costs, Kidd said, utilities should be cautious of full-scale acceptance of reclosers for main feeder protection.

Ampere demand to justify economic selection of distribution conductor never exceeds a third of the current-carrying capacity, so that provision for future load growth is automatic. Thorough economic analyses at 16, 11 and 4 kv confirm Southern California Edison Co's practice, said E. R. Sample. New Edison circuits expected to carry 150 amp within two years will be equipped with 653.9 MCM ACSR.

Utilities should reappraise distribution transformer loading practices, urged A. M. Lockie, Westinghouse. Typical user studies to find economic transformer sizes show the load limit usually is economic rather than thermal. And evidence grows

(*Continued on page* 97)

SANGAMO CLASS 200 P2S **ACCURATE·ECONOMICAL**



A CLASS 200 POLYPHASE METER

in your *standard singlephase cover*

IMPROVED LOAD CHARACTERISTICS. P2S Class 200 Meters start at ¼% of rated load and provide accurate measurement to 666⅔% of rated load. This means that you can *accurately measure loads from 18 to 96,000 watts* with Type P2S Class 200 Meters.

GREATER OPERATING ECONOMIES. One meter, the 240 volt P2, can be applied to 120/208, 240/416 and 277/480 volt network systems, also to 3-wire 3-phase, and 3-wire singlephase circuits *without special calibration.* Accurate registration is obtained from 42% to 125% of rated voltage.

All Type P2 Polyphase Meters have been substantially reduced in height. The cover, interchangeable with the singlephase metal base socket meter cover used for the past twenty years, can be readily replaced from your existing cover stocks.

STABILITY. P2 Meters give sustained accuracy because of Sangamo's precise factory calibration... skillful design... careful selection of materials ...and rigid control of manufacturing processes.

SLOW SPEED. The advantages of slow disk speeds, proved so well in the Sangamo J2 Meter, have been incorporated to an even greater degree in P2 Meters. Reduced current and potential damping provides *greater inherent accuracy.*

* * *

The complete line of LIFETIME GUARANTEED Sangamo Type P2 Meters will handle all polyphase measurements.

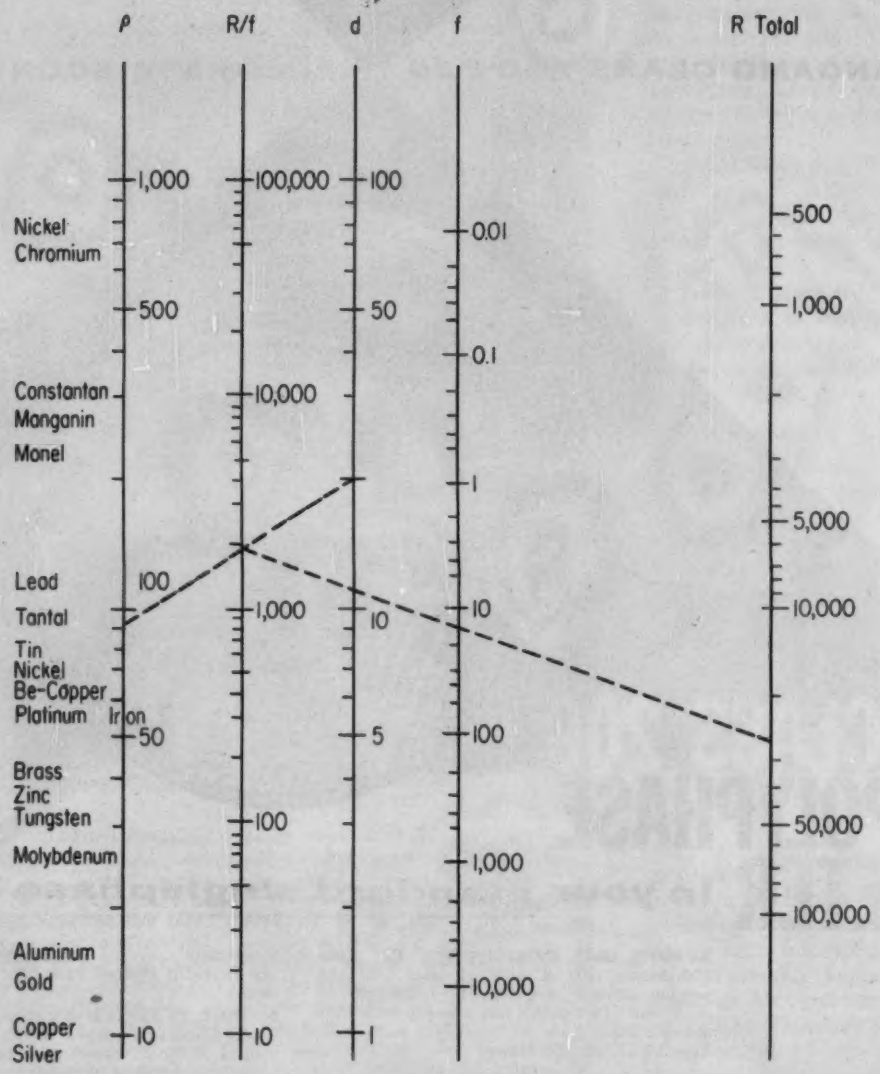
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

JM58-6

Nomograph to Determine Resistance of Wire

FEDERICO STRASSER, Electrical Engineer, Santiago, Chile



Accompanying nomograph is an aid to determine quickly the resistance in ohms of round wire. The graph is usable when the diameter, length and material of wire are known.

How to Use the Nomagraph

First or left scale indicates the specific resistance (ohms per circular mil-foot) for several conductor materials. The third scale indicates the wire diameter (expressed in circular mils, i.e., thousandths of an inch). A line connecting the points of specific resistance and diameter intersects the second scale and at that point gives the resistance per foot length (R/f) of wire.

At the R/f point a line connects the fourth scale for the wire length in feet, and is extended straight to the fifth (or right hand) scale. At the latter point of intersection is given the total resistance for the wire.

Example:

Given a tantal wire, 20 cm diam and 14 ft long. Following the foregoing procedure and the dash-line, the resistance per foot is about 1900 ohms per cm-ft, and total resistance is 26,600 ohms.

UNIFORMITY

"VICTOR SUSPENSIONS—

NOT ONLY LOOK ALIKE—
THEY PERFORM ALIKE,"

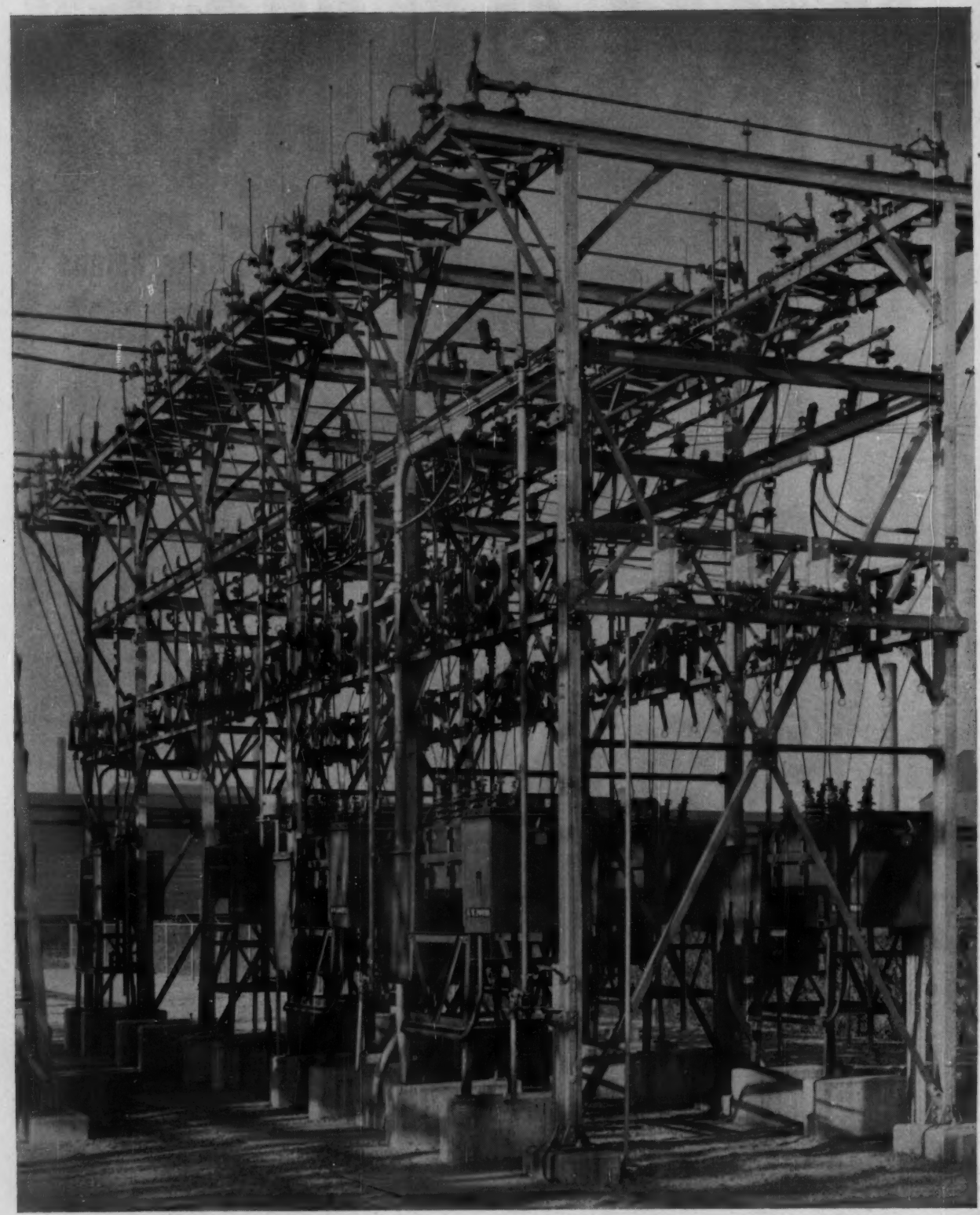
says Robert L. Perry,
Factory Manager,
Victor Insulators Division,
I-T-E Circuit Breaker Co.

Why try to cut corners with suspensions whose mechanical and electrical characteristics may vary all over the lot? Be sure of uniformity with VICTOR Suspensions. They are made by the carload, year after year, yet each insulator is identical. Each has a built-in margin of safety that precludes failure on the line.

Big reason for this amazing uniformity is Purified Porcelain. This porcelain is denser, harder, stronger, has greater uniformity than any insulator porcelain ever made! Segregation and analysis of each shipment of raw material, scientific proportioning of ingredients, demineralization of all processing water and the use of densitizing pug mills make Purified Porcelain possible.

These processes together with quality-controlled manufacturing, and rigid, routine testing techniques make truly superior insulators. You just can't buy better suspensions—at any price!

I-T-E CIRCUIT BREAKER COMPANY
VICTOR INSULATORS DIVISION
Victor, New York



THIS STRUCTURE WENT UP IN A DAY

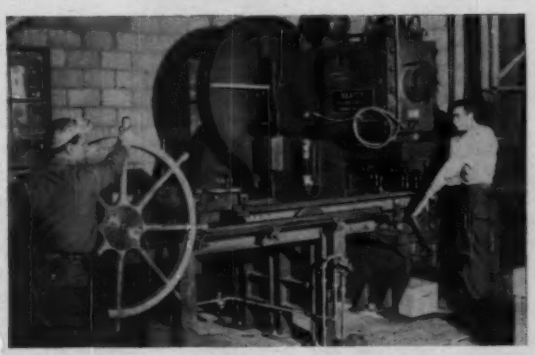
It's aluminum—it's light and strong—it will last

R&IE designs and fabricates aluminum or steel substation structures under one roof. Complete control and supervision virtually eliminates on-the-site rework, thereby speeding installation.

Some 7000 prepunched holes were required for this structure, and no rework was necessary for proper fit. This aluminum alloy structure for Penelec in Erie, Pa., was erected in one day, ready for equipment and bus work. An identical galvanized steel structure could have been erected in a proportionately short time. Accurate detailing, fabricating and member identification resulted in orderly and fast field assembly.

Fast installation . . . proper design . . . efficient use of materials . . . these are extra benefits for you made possible by R&IE's complete engineering and manufacturing facilities. Experienced substation engineers study your particular requirements . . . electrical clearances, wire pull, weather and switching. Designs reflecting their specialized knowledge are then translated, via detail drawings, into fabricated parts. Engineering, design and fabrication all take place under one roof. Of all substation manufacturers, R&IE alone has offered this unified, complete service for almost half a century.

If your planning includes substation structures for transmission, distribution or industrial service entrance, let R&IE's longer, broader experience save you time and cost. For full information, consult your I-T-E representative or write R&IE Equipment Division, Greensburg, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ont.



Substation specialists. R&IE craftsmen, using custom-designed tools and machines, such as the unique punched hole spacing table shown here, are specialists in the production of substation structural components. Specialized tooling and skilled workmanship assure on-time delivery and rapid, trouble-free assembly.

I-T-E CIRCUIT BREAKER COMPANY
R&IE EQUIPMENT DIVISION · Greensburg, Pa.

Green Garden substation, Erie, Pa. Built for the Pennsylvania Electric Co., with use of preassembled trusses. All-aluminum construction reduces maintenance to an absolute minimum. The first all-aluminum substation ever built was produced by R&IE in 1947.

Ormet Al Plant Readied for Full Operation

Second largest aluminum reduction plant in United States is in production, advises Walter F. O'Connell, president, Ormet Corp. Full scale operation at the $110 million Ormet facility is scheduled for the end of 1958.

The new facility has an annual capacity of 180,000 tons of primary aluminum. When in full production, Ormet will be the nation's fourth largest aluminum producer, said the president.

One reduction pot line totaling 168 pots, an electrolytic cell, is in routine production and has a daily output of approximately 100 tons of metal, continued O'Connell. Remaining four lines are to be brought in at 60-day intervals.

Ormet formed in August 1956 is owned jointly by Olin Mathieson Chemical Corp and Revere Copper and Brass Inc. The plant is located in Ohio, about 40 miles from Wheeling, W. Va.

O'Connell reported the facility is currently receiving power from the American Electric Power System. Power will be supplied shortly from the Kammer Plant of Ohio Power Co at Cresap, W. Va., when the first of three 225,000 kw generating units go into operation. The Kammer plant will generate its power from coal mined at the adjacent Ireland Mine of Consolidated Coal Co.

Shown is push-button pouring. Here a crane operator controls the pouring of molten aluminum into 1000-lb pig molds from a 7000-lb capacity crucible.

A carbon plant at the Ormet facility has been in production to build-up an inventory of rodded carbon anodes. At full production the aluminum plant will consume approximately 90,000 tons of carbon a year.

An Olin Mathieson rolling mill, with 120,000 tons annual capacity for flat and coiled rolled aluminum products, is adjacent to the Ormet reduction plant. The rolling mill will be completed later this year.

Bushings 45 Years Old Pass Today's Tests

Paper-wound condenser bushings met modern test standards after a 45-year service by Metropolitan Edison Co, according to Westinghouse Electric Corp. The bushings were used on the manufacturers Type GA 44-kv, 300-amp oil circuit breaker.

Tests showed an average power factor of less than 5%. Radio influence level was measured 10% above rated line-to-ground voltage. Valves averaged 57 mv against an industry standard of 1250 mv allowable for today's 46-kv bushings.

One of the "old-timers" also met these tests in Westinghouse's laboratory: A 60-cycle, 1-min dry test at 120 kv; an instantaneous 60-cycle test at 230 kv; followed by five 1.5x40 full-wave impulse shots at 250 kv.

Precipitator to Operate Soon on Waukegan No. 7

An electrostatic precipitator has been designed to remove fly ash at the rate of more than 600 lb per min from stack gases. It will go into service soon when the Commonwealth Edison Co begins operation of its No. 7 unit at Waukegan, Ill.

One of the largest such units for the power generating industry, it was built by the Metal Products Div, Koppers Co, Inc., Baltimore. Installation consists actually of two precipitators side by side within a single shell approximately 150 ft wide, 33 ft high and 25 ft long.

Each precipitator has three separately energized fields. A total of nine vacuum-type power units are part of the installation, the precipitators will handle a gas volume of 1,116,000 cfm emitted from a twin reheat boiler rated at 2,100,000 lb of steam per hr and using pulverized coal as fuel.

Reynolds Exercises Option

Reynolds Mining Co, Buffalo, Wyo., a subsidiary of Reynolds Metals Co, has exercised its option to purchase some 1,500 acres of coal land adjoining Lake DeSmet in northern Wyoming. Pacific Power & Light Co has been working with Reynolds on plans for a steam power plant at the lake.

(*More MN on page* 68)

GUY-GRIP dead-ends...
the modern twist in guying
The picture comparison makes GUY-GRIP dead-end benefits obvious.
1. THE ASSEMBLY LOOKS BETTER...
slim, modern GUY-GRIP dead-ends, free from bolts, give your guying jobs a finished, craftsmanlike appearance.
2. YOU SAVE HOURS OF COSTLY TIME...
takes only a minute to install a GUY-GRIP dead-end — about the same time spent in securing one nut and bolt.
3. YOU ELIMINATE ALL TOOLS...
wrenches, pliers, and other tools are completely unnecessary in applying GUY-GRIP dead-ends. The operation is done entirely by hand.
4. ASSURES POSITIVE GRIP...
under all field conditions, whether the guy is relaxed or under tension. Once the legs of the GUY-GRIP dead-end are entirely applied to the strand, you know the assembly is complete and permanent.
5. RESISTS STRAINS AND WEATHER...
GUY-GRIP dead-ends can take an unbelievable beating. Tension, impact, temperature extremes . . . whatever force is exerted against GUY-GRIP dead-ends, they withstand the most extreme conditions, never relinquishing a single ounce of their gripping power.
These are only a few of the many reasons why you might want to try the modern twist in guying. Write for more information: Preformed Line Products Company, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland.
PLP
10
Power Line Progress
You can look up to
Preformed
Made in accordance with or for use under U. S. Patent No. 2,761,273, other patents issued and pending.

have your

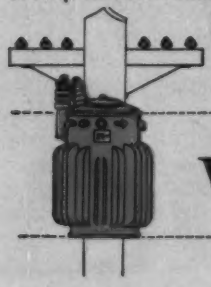
Westinghouse representative

tell you how you can

HANDLE PRESENT DISTRIBUTION LOADS LONGER ...NO ADDITIONAL INVESTMENT

Now—the Insuldur® insulation system assures you of increased transformer life, without additional cost . . . Another answer to changing needs because Plowback of earnings into research maintains Westinghouse leadership in distribution transformer development.

J-70846



YOU CAN BE SURE...IF IT'S

Westinghouse

Steam Turbines To Power Boiler Feed-Water Pumps

Two mechanical-drive steam turbines to operate boiler feed-water pumps will be used in connection with one of the largest super-critical pressure electric generating units. The turbines have been ordered by Philadelphia Electric Co from General Electric Co's Small Steam Turbine Dept.

Steam-turbine generator unit is rated at 325,000 kw with steam conditions of 3,500 psi, 1050/1050F. It will be installed as Unit No. 2 in the power company's Eddystone Station.

Each high pressure boiler feed pump turbine is rated 5000 hp, 5200 rpm and will use steam taken from the first reheat line at 1070 psia, 734F and exhaust to the second reheat line at 348 psia.

This will be the second boiler feed pump turbine application for supercritical pressure steam turbine-generator units. Two turbines have been shipped for installation in the Cleveland Electric Illuminating Co's Avon Station for use with a 250,-000-kw unit.

Delta-Star Shipped First Interrupter With Resistor

First 3-pole vacuum tube interrupter with resistors mounted alongside and incorporated on a disconnect switch (MKV 40) has been shipped by Delta-Star Div, H. K. Porter Company Inc.

The vacuum interrupter units consist of five smaller tubes inside one large Pyrex tube per phase. The MKV-40 switch is rated 46 kv nominal, 600 amp with 20,000 amp momentary capacity.

Each resistor unit is designed with 10,214 minor coils extending 102 ft, wound into 81 major coils from 736 ft of straight wire, and contained inside a Pyrex tube approximately 6 in. in diameter and 3 ft long. As the switch closes, these resistors limit inrush current to 700 amp.

This switch is used for interruption of load and charging currents and the switching of large banks of capacitors.

Second Carload of Fogbowls is Prepared

A second carload of No. 961 porcelain insulators, known as the Fogbowl, are being prepared for shipment to a major utility. Here are pictured the packing and plant transportation operations at Victor Insulator Div, I-T-E Circuit Breaker Co, Victor, N. Y. The disk insulators of the suspension type are assembled in 5-unit strings and packed in wood crates. Installation in the west will be in a severely contaminated atmosphere.

Field service tests show these insulators to have low leakage currents, according to the manufacturer. The units have a trapped air space within the insulator bowl to reduce contamination on the surface.

Federal Pacific Graduates Six Industrial Specialists

The first "class" of six industrial product specialists have been graduated at the Federal Pacific Electric Co, Newark, N. J. The course, part of the company's program to train engineers specifically to service the Original Equipment Market, was given to a specially selected group of Federal Pacific personnel. They will be assigned to various company offices throughout the country, to back up the efforts of regular Federal Pacific sales and field engineers now working with original equipment manufacturers.

U. S. Refined Copper Stock Is Largest Since 1939

Refined copper stocks in the United States at the end of April totaled 251,099 tons, according to the Copper Institute, New York. This amount is reportedly the largest since 1939. And, world refined stocks (combined totals in U.S.A. and outside U.S.A.) amounted to 501,500 tons, the highest stock level for over six months.

U. S. primary production during April was 86,014 tons, lower by 4,320 tons from March. Refined copper production amounted to 120,467 tons for April, down about 9,600 tons from the preceding month. Deliveries to fabricators totaled 81,344 tons, an increase of 2,660 tons over the 78,683 tonnage for March.

Remote-Controlled Crane

Anthony Co, Streator, Ill., has a remote-controlled, 5000-lb truck crane. A single operator can control the swing of the boom through 280 deg, the load at the point of operation, as well as operate the crane.

Now...
stop line outages
caused by birds
and squirrels...

NEW PLASTIC-COATED COVERS ON WESTINGHOUSE DISTRIBUTION TRANSFORMERS

Have your Westinghouse representative give you the full story about . . . another answer to a changing need.

J-70845

YOU CAN BE SURE...IF IT'S
Westinghouse

Pigsaver Answers Farmers' Pig Problem

Hog raisers now have an answer to the problem of saving baby pigs from under- and over-size litters, orphans and runts. The Pigsaver, manufactured by Norwood Products Co, Luverne, Minn., automatically feeds warm sow's milk replacer to eight pigs at a time. It can also be used for lambs.

The Pigsaver, which is UL approved, is an 8-qt milk kettle 18½-in. high, 8½-in. in diameter, with a 22-in. base. It has a 330-w heating element factory-set thermostat.

A thermostatically controlled heating element keeps the milk at the proper temperature in the milk kettle and the milk is fed through eight anticolic nipples, with nipple guards. The manufacturer reports that the pigs can get all the milk they need when they want it and the bother of bottle or hand feeding is eliminated.

Four Ranges Awarded in TECO Campaign

Four new electric ranges for Hampa Electric Co customers were the prizes in a TECO "Springtime of Your Life" electric range contest.

To participate, entrants visited dealer stores and fill out a coupon. A drawing at the end of the contest determined the winners. If a winner purchased an electric range from a dealer in the company area during the campaign period, the utility refunded the purchase price. Tampa Electric home economists gave a use and care demonstration to all electric range purchasers.

Cash awards to dealer salesmen were on the basis of a minimum of four sales, with $1 awarded for the first sale, $2 for the second, $3 for the third, $4 for the fourth, and $4 for each additional sale over four.

Btu Campaign Endorsed

Carrier Corp's recent announcement to drop horsepower ratings in favor of Btu's for room air conditioning capacities (EW, Apr. 21, 1958, p 104) has received "surprisingly enthusiastic support." Russell H. Gray, vice president in charge of the Unitary Equipment Division reports that three major air conditioning manufacturers have endorsed the company's stand. The National Better Business Bureau also commended Carrier on its position and is distributing reprints of the company's policy declaration to local offices.

Electric Ranges Promoted for Sixth Year at SMUD

Sacramento Municipal Utility District has sponsored a contest to promote the sale of electric ranges for the sixth straight year. The campaign featured a giveaway of 10 ranges, plus salesmen benefits.

New features included: entry blanks with questions which tend to force entrants to ask dealers and salesmen pointed queries on electric cooking; and a requirement that entrants deposit the blanks at dealers' stores.

Salesmen's benefits included a special bonus for each range sold and a jackpot drawing.

EEI Directory Lists Sales Training Aids

A Directory of Training Materials, for use by utility sales executives and their sales allies, has been compiled by EEI's Sales Personnel and Training Committee.

The 14 sections in the book list films, slide sets, scripts, tape recordings, training kits, booklets and manuals used for training salesmen. Sections include: electric cooking, refrigeration, space heating, air conditioning, heat pump, laundry, wiring, lighting, atomic power, and supervisor and management training. Copies may be obtained at $2.50 each from Commercial Dept, EEI, 750 Third Ave, New York 17, N. Y.

Appliance Use Estimated

Families who buy electric refrigerators and ranges use them for an average of 15 years; electric washing machines, both automatic and wringer spin-dryer, are replaced after nine years; and second-hand items last about half as long, according to estimates of the Department of Agriculture. They were calculated by home economists and statisticians of the Dept's Institute of Home Economics from data collected by the Bureau of Census.

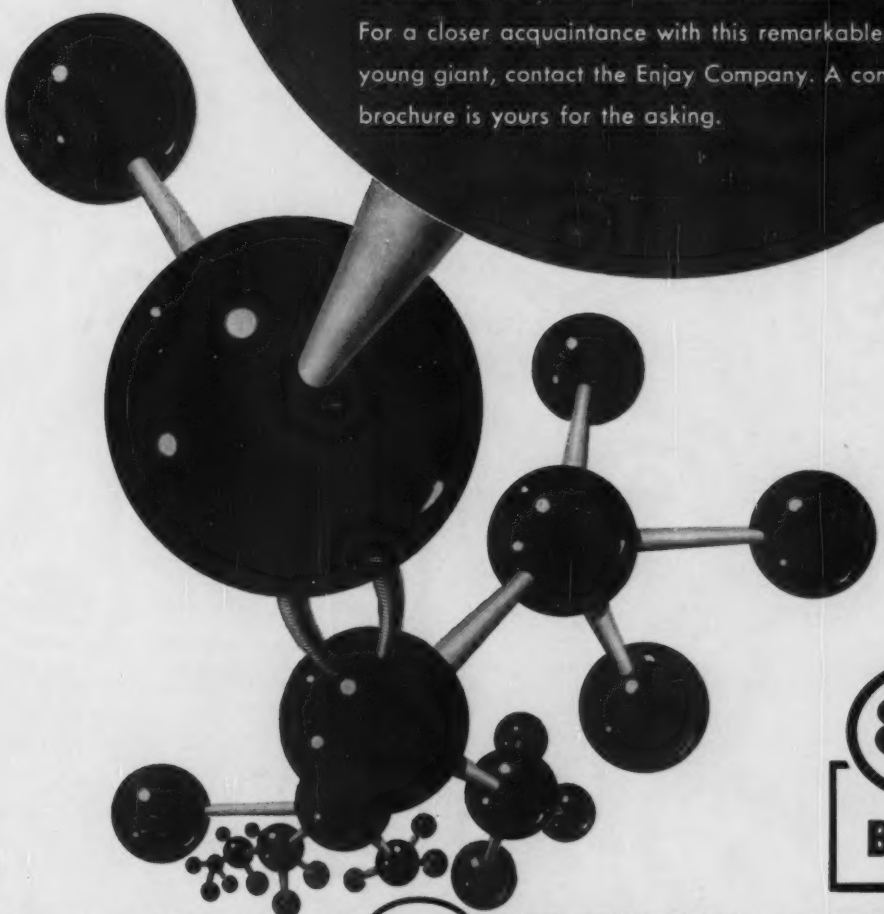
(*More Selling on page* 75)

the growth of a giant...

. . . Enjay Butyl rubber, a man-made giant molecule. Invented in 1937, first produced in 1943, Butyl went immediately to war, replacing natural rubber for the manufacture of inner tubes.

Since the war, Butyl has been applied to many other exciting uses. Its wide variety of outstanding physical, chemical and dielectric properties give it a versatility unmatched by any other rubber, natural or synthetic. Today Butyl makes possible better quality automotive, electrical, industrial and domestic products.

For a closer acquaintance with this remarkable young giant, contact the Enjay Company. A complete brochure is yours for the asking.



ENJAY BUTYL

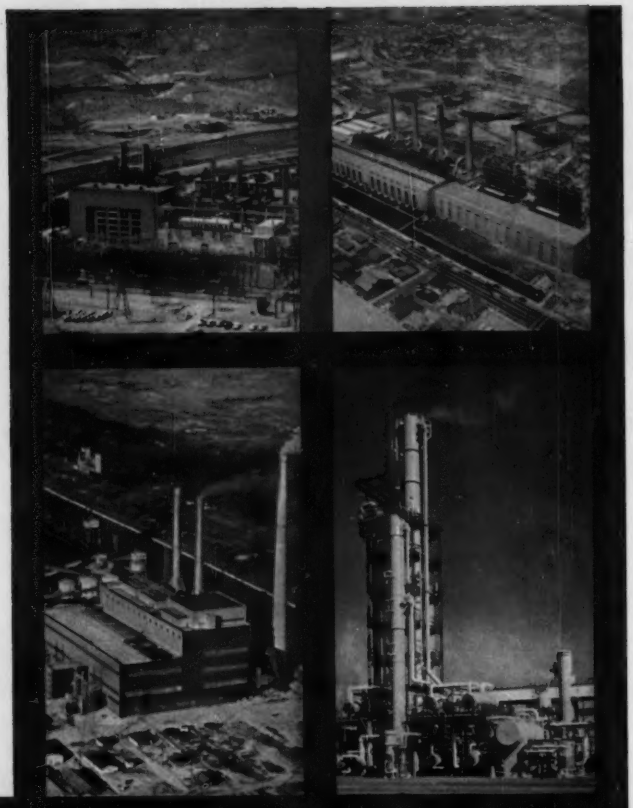
Pioneer in Petrochemicals

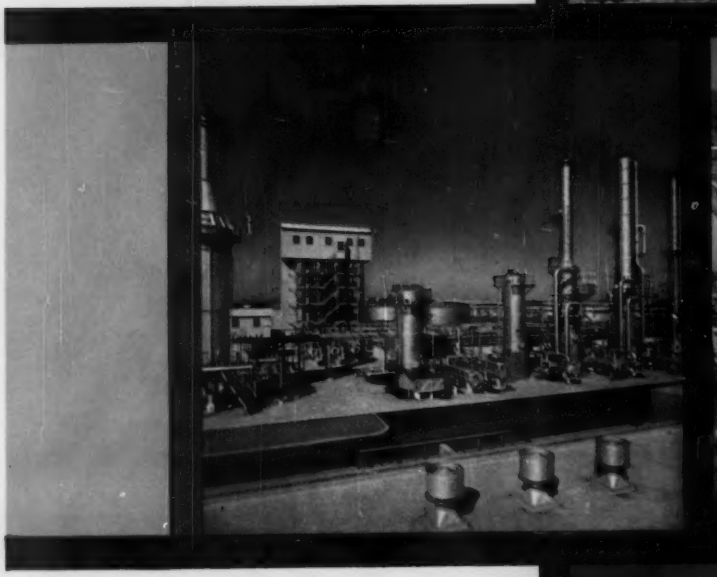
ENJAY

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.

Akron • Boston • Charlotte • Chicago • Detroit • Los Angeles • New Orleans • Tulsa

9 bright new lights in the industrial world





Stone & Webster Engineering Corporation brings a world of experience to new projects and problems . . . all around our growing industrial globe.

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New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

Union Electric solves a crowded channel problem

with General Electric Progress Line mobile radio

Expansion plans at Missouri's Union Electric Company called for more radio-equipped trucks. But new trucks could not be handled by the existing radio system.

So Union Electric went to Ultra High Frequency for its new base stations at Alton and St. Charles and chose G-E Progress Line equipment.

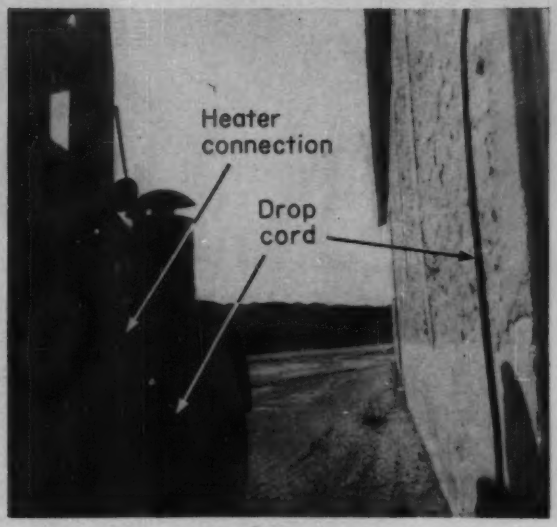
For the utmost in reliability, General Electric's Progress Line now offers the widest variety of thermostatically-protected transistor-power mobile radios available, up to and including 100 watts in low band.

General Electric uses pre-tested communication-type tubes for longer service life . . . controlled reluctance microphones for the clearest possible voice fidelity. What's more, Progress Line equipment is completely interchangeable—chassis for chassis, even between mobiles and base stations—to speed servicing and reduce downtime.

The G-E communications consultant in your area can help you plan an efficient, low-cost radio system. Give him a call. He's listed under "Radio Communication Equipment" in the Yellow Pages. Or write General Electric Company, Communication Products Dept. 968-2, Syracuse, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Drop cords serve 13 trucks in garage . . . and a dozen parked outside as . . .

Diesel Engine Heaters Save $5,000 per Year

S. E. ABELL, Industrial Engineer Ohio Edison Co, Sandusky, Ohio

An estimated $5,000 a year has been saved by the installation of submerged electric heaters in circulation systems of heavy diesel trucks at the Chemstone Corp, Marblehead, Ohio. The 2.5-kw heaters assure prompt starting on cold mornings. Maintenance charges on engine and battery wear are now lower. A complete steam heating system was retired and a licensed fireman's time eliminated by the installation of drop cords to each truck where it was night parked. The heat is used only where and when it is needed.

In the past, it was necessary to have the truck housed in a heated building to assure prompt starting on cold mornings. This required a cement block building with insulating qualities to reduce the fuel heating costs.

New Building Obviated

When additional trucks, used to transport mined limestone from a quarry face to rock crushers, were added to the company fleet to handle increased business, the cost of constructing a new building was saved by parking the trucks outdoors. Electrical connections were provided outside the garage and the trucks connected to the controlled system.

The installation has facilities for 13 trucks inside the building and 12 trucks outside. Total load is 75 kw.

Power supplying the heat is controlled by a time clock which starts operation about 4 a.m. so that the trucks will be ready to go at 7 a.m. Drivers can get into warm cabs with the engines ready for full operation. On Saturdays, Sundays and non-quarrying days, the truck heaters are manually disconnected, resulting in even further savings. Three, 25-kva, dry-type transformers convert the 440-v distribution supply to 220 v to supply the truck heaters.

Electric Heat Ends Hot Water Shortage

DONALD GROOME, Power Sales Engineer, Pennsylvania Power & Light Co, Lancaster, Pa

Five 10-gallon electric water heaters put an end to a shortage of hot water for laboratories and wash rooms at Penn Dairies, Inc, Lancaster, Pa. Located at the point of use, the two-kv units have short pipe runs and can supply immediate hot water. They are mounted above the floor, in otherwise useless space. Moreover, they provide simple, accurate control of the water temperature.

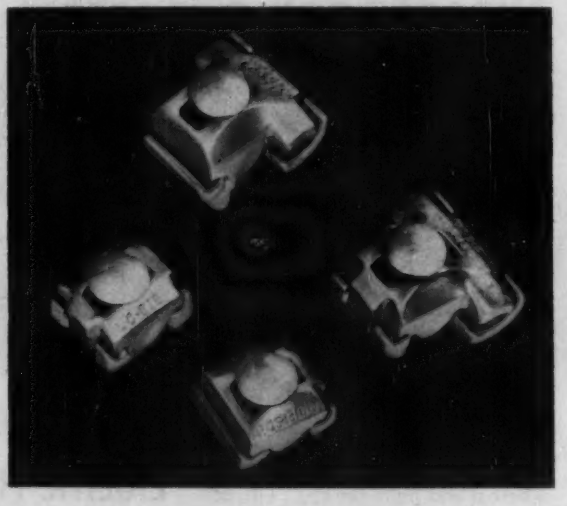
The new heaters were installed when the existing central hot water system proved unable to supply water at the temperatures required by the state inspectors. Although Penn had considered installing another tank heated by steam coils, the availability of the electric heaters and their operating advantages convinced the company that the electrical units were the better choice.

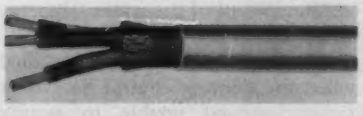
Network Analyzer . . .

. . . with building block design can be expanded from basic unit on 3 generators and 24 circuits to maximum of 21 generators and 400 elements. Simple, flexible control center includes network patchboard, metering and switching controls, and basic power for entire analyzer. Unit uses 4,000-ohm base to cut set-up and analysis time and eliminate overloads. Five-deg. phase shift compensates for loss in resistance of inductance units. Each generator has independent magnitude and phase angle controls for varying voltage and power output. **I-T-E Circuit Breaker Co, Switchgear Div, 19th and Hamilton St, Philadelphia 30, Pa.**

Parallel Groove Connectors . . .

. . . can be worked hot with Vise Grip pliers. Bolt forces are applied along bolt centerline to reduce relaxation and bolt bending. For better cable containment, aluminum to aluminum connectors have heavy interlocked fingers on both sides. Contact design eliminates contact overhang. These Series LC-50, LC-80, and LC-800 one centerbolt connectors are available in 21 sizes, and can be ordered with liners or plating for bimetallic connections or bare for aluminum to aluminum. All are treated with inhibitor.
Anderson Electric Corp, P.O. Drawer 2151, Birmingham 1, Ala.





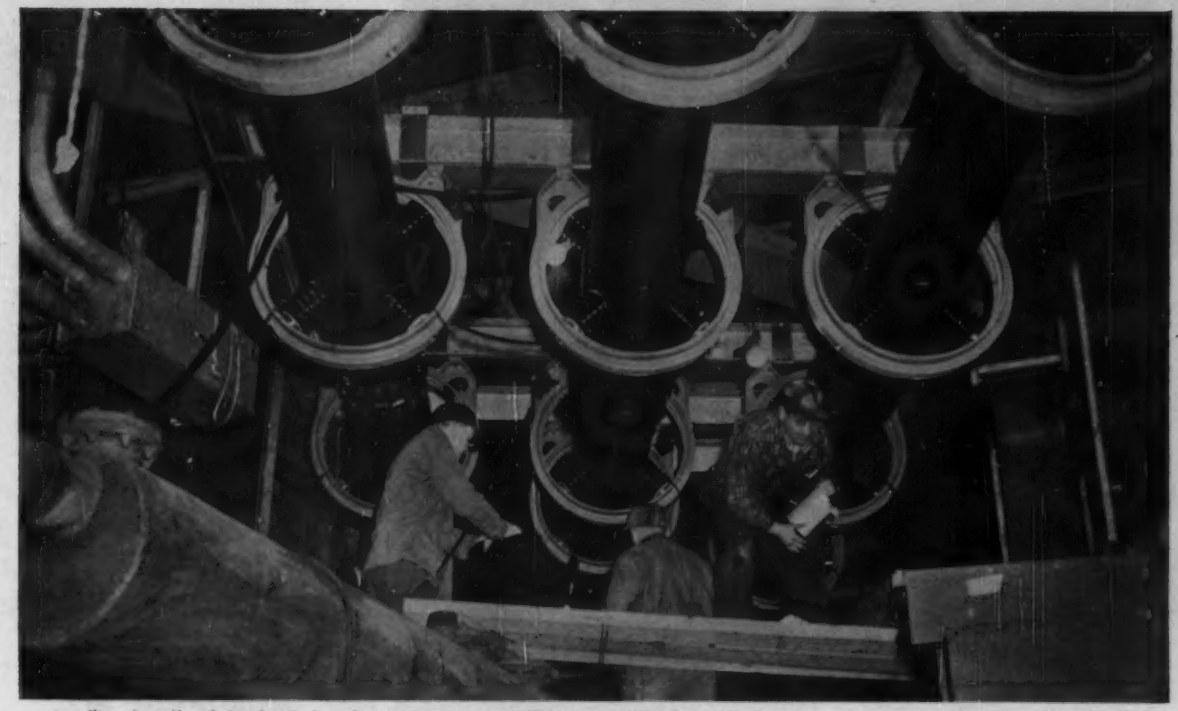
Al Sheath Cables . . .

. . . in sizes to 1,000 MCM single conductor and No. 4/0 3-conductor have GR-S, oil base, butyl, or silicone rubber insulation. Sheath is extruded, permitting longer continuous lengths. Cable is easily worked, moisture proof, and light weight. Aluminum sheath thickness is 40 to 85 mils. Line includes control and power cables. Samples available. **General Cable Corp, 420 Lexington Ave, New York 17, N. Y.**

6-Mw Portable Plant . . .

. . . for peaking and reserve generation comprises three 2-Mw Diesel generating units, each in weatherproofed, sound-deadened steel housing, and one control unit. All user has to do is install fuel tank, provide concrete or stone-and-railroad tie base, and couple cabling. Plants are designed for completely automatic operation and can be brought on the line, completely loaded and synchronized, in 90 sec. Fifty-ton generating units and 17-ton control units can be shipped on 40-ft flat car and transferred to low-boy trailer for hauling to installation site. **Electro-Motive Div, General Motors, La Grange, Ill.**

(*More New Equipment on page* 78)



Installing the self-cooled isolated phase bus structure to carry 6500 amps at 20 kv from the generator to the power transformers at Steam Turbo-Generator Unit #3 at the Astoria Station of the Consolidated Edison Co. The tubular copper bus, 13½" O.D., .406" wall thickness, is wrapped with black insulating tape prior to installation.

Big Tubular Copper Bus Carries 6500 amps at 20 kv

At its #3 Steam Turbo-Generator at Astoria, L. I., the Consolidated Edison Company uses these large Anaconda tubular copper conductors to carry generator output to the power transformer. These special conductors are another example of how Anaconda can help meet special conditions. Though well beyond the standard-pipe-size copper bus tube, they are by no means the largest. Anaconda can produce seamless copper tubes up to 26 inches, I.D.

13½" O.D. x .406" tubular bus being fabricated at R & I E Equipment Div. of I-T-E Circuit Breaker Co., Greensburg, Pa. Everdur® nuts are silver-alloy brazed inside the tube and the bolts withdrawn. Then in assembly at the site, the nuts are in place for fast, easy installation. A total of 1,128 feet of tubular bus was required.

In general, where mechanical requirements permit, bus costs can be cut through the use of tubular bus conductors with low wall-thickness-to-diameter ratios. The weight of metal purchased goes down as the t/d goes down. Round tubes in the standard pipe dimension, and thin-wall sizes, also offer other advantages. They make it possible for you to utilize the great variety of stock sizes of supports, connectors, clamps, and other line hardware.

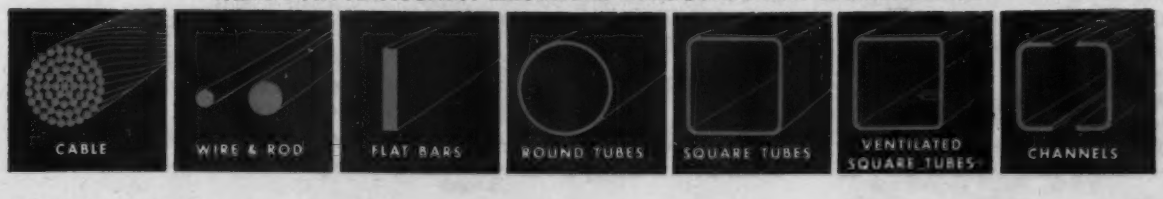
TECHNICAL SERVICES. Anaconda specialists are available to help you in the solution of technical problems involving the use of Anaconda Bus Conductors. For such service, or for a copy of Publication C-25, see your nearby Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn.

ANACONDA®

COPPER CONDUCTORS

Made by The American Brass Company

THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED



Ask your
Westinghouse representative
about the exclusive benefits
you get from

URL AND URF REGULATORS...WITH THE TAP CHANGER THAT'S 15 TIMES FASTER

Westinghouse URL and URF regulators are equipped with a direct-drive Geneva gear tap-changing mechanism. The motor-driven mechanism operates instantly when a tap change is called for, thus taking advantage of the inverse time characteristics of the computing type CVR relay control.

This direct-drive mechanism corrects voltage 15 to 20 times faster than any spring-driven mechanism. Because there is no wind-up time, full-range operation requires a maximum of only 13 seconds, compared to 3½ to 5 minutes for other drives.

Elimination of this unnecessary time delay allows a 1½-volt correction in only 1 second, assures a narrower effective bandwidth, with better voltage control and improved customer service.

See your Westinghouse representative for the full story of better regulation—made possible through PLOWBACK OF EARNINGS into research . . . to help solve the immediate and long-range problems of the electric utility industry.

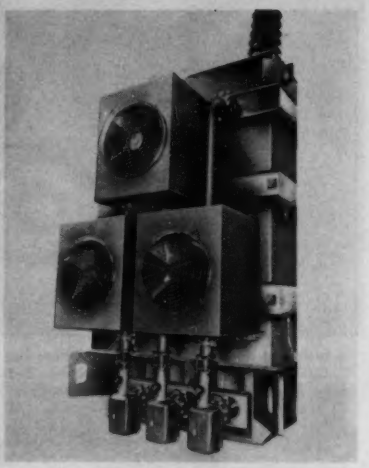
J-70860

YOU CAN BE SURE...IF IT'S Westinghouse

Voltage Regulators . . .

. . . for feeder applications are available in 3-phase ratings of 500 and 750 kva for 8,660-v use and 500, 750, and 1,000 kva for 13,200 v. This line requires less installation space, and weigh less than their predecessors.

Allis-Chalmers Mfg Co, Milwaukee 1, Wis.



Transformer Cooler . . .

. . . requires little auxiliary power per kw loss and is easily assembled in field. Now standard equipment on forced-oil-cooled power transformers, this Type A forced-oil-to-air cooler has greater number of pumps, to reduce loss of cooling when one cooler is out of service. Coolers are completely interchangeable, permitting use of any cooler on any transformer. Components weigh only 850 lb, compared to 4,000 for older 9-fan cooler.

Cooler handles 5 gal of oil per min. and has high pressure, low velocity fan to move large volume of air. Standard 220/440-v motor has overload protection.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Weather Protected Motor . .

. . . for station auxiliary and industrial use is offered in ratings from 150 to 1,000 hp at 1,800 rpm. The enclosure of this vertical motor keeps vital mechanical and elec-

trical parts dry, even with filters removed, under spray velocities of 80 to 100 mph.
General Electric Co, Schenectady 5, N. Y.

Warning Beacon . . .

. . . for repair trucks and emergency vehicles produces readily visible, 360-deg flashing pattern. Super Beacon Ray has four sealed beam spotlights to permit slower rotation and longer flash period. Beacon rotates 95 deg, then reverses, producing unusual flash pattern. Glass dome may be red, green, blue, amber, or clear white. Models for 6-v and 12-v service are available in permanent mounting, stanchion mounting, and demountable types.
Federal Sign & Signal Corp, 8700 S. State St, Chicago 19, Ill.

Carrier Voice Adapter . . .

. . . is transistorized unit for emergency voice communication between power stations. Plug-in unit can be used in installation and initial adjustment of Type KR carrier and in other applications where frequent communication is either unnecessary

or undesirable. Extra burden is only 0.1 amp. One adapter may be used with several transmitter-receivers. Circuit is designed to give relaying function and supervisory control preference over voice communication.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

More New Products

Form H station-type **lightning arresters** have graded internal gaps in each 12-kv unit to give transient overvoltage protection up to point of external flashover in heavily contaminated atmospheres. May be hot-washed using established techniques. —General Electric Co, Schenectady 5, N. Y.

Two-way, 100-w **mobile radio** with fully transistorized power supply has 60-w radiophones in 144-174 MC band and 50 and 100-w in 25-54 MC band. Radiophones can be operated from any 12-v primary power source. — Motorola Communications & Electronics Inc, Dept T, 4501 W. Augusta Blvd, Chicago 51, Ill.

DR-2000 AH **ultrasonic cleaner** has 150-gal capacity tank fitted with 20 bottom-mounted transducers driven by a simple pulsed generator delivering 8-kw peak power. Uses either solvent- or water-detergent solutions.—Acoustica Associates, Inc, Minneola, N. Y.

Non-lubricated ESH-NL **compressors** for heavy duty service where air and gas cannot be allowed to contact lubricants are available for sizes from ½ to 2,000 hp.—Ingersoll-Rand, Phillipsburg, N. J.

Oil-tight, plug-in **limit switch** is wired without disassembly, can be plugged in with six different mounting arrangements. It requires 5 deg to operate, provides for 25 deg overtravel. Bulletin 9007-AW.—Square D Co, 4041 N. Richards St, Milwaukee 12, Wis.

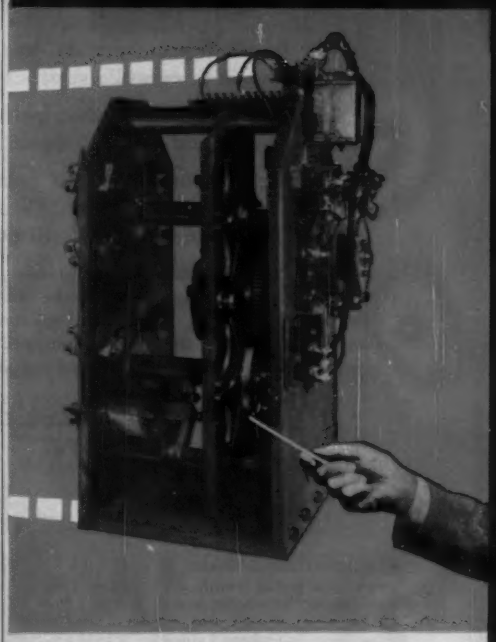
Portable, self-priming **pump** has 7,000 gphr capacity. Lightweight unit is powered by 2¾ hp, 4-cycle engine with built-in exhaust valve rotator. Bulletin 363.—Hale Fire Pump Co, Conshohocken, Pa.

Danger **flag tripod** for street, highway, industrial plant or emergency blockade use is 55 in. high in service and 30 in. folded, weighs 9 lb. Eight-oz red canvas flags are 16x16 in.—Industrial Products Co, 2808 N. Fourth St, Philadelphia 33, Pa.

(*More New Products on p* 80)

EXCLUSIVE DIRECT-DRIVE GENEVA GEAR MECHANISM...

* No shock
* Fast arc extinction
* 15% less contact erosion



The exclusive direct-drive Geneva gear tap-changer mechanism in URL and URF regulators provides a sinusoidally controlled motion which:

- Changes taps smoothly, with no mechanical shock to loosen components.
- Provides correct speed for arc extinction.
- Reduces contact erosion by 15%.
- Permits 1¼% steps, which improves regulation and cuts maintenance. J-70859

YOU CAN BE SURE...IF IT'S
Westinghouse

Combustion Control Cubicle for electric power plant. Totally enclosed ¼ in. steel housing. Completely wired and tubed for pneumatic operation. Includes draft gauges, recording equipment, annunciator panel, pressure gauges, various instruments.

You CAN get more per-dollar

The finest instrumentation and control panels—but often competitive in price while superior in quality.

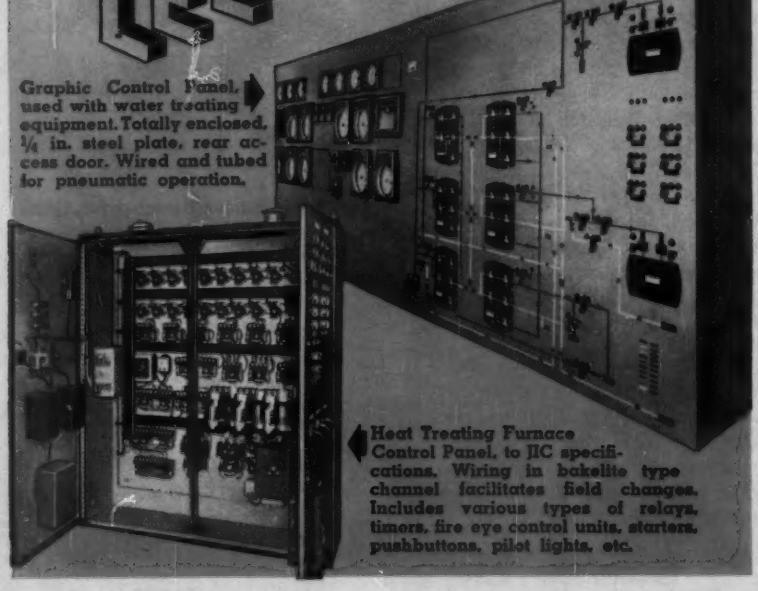
Exceptional value is what has increased LEE sales 100-fold in five years. Plant capacity again being doubled.

We engineer and build to customer's specifications Electrical Control Panels, Cubicles, Consoles, Instrumentation Cubicles, Electrical and Power Distribution Equipment.

Mimic flow diagrams are painted— plastic— or aluminum strip. Instrumentation cubicles include tube and pipe ¼ in. to 3 in. with air headers, pressure regulators, and all runs of tubing to bulkhead fittings for easy field installation. We're equipped for any type of steel fabrication including ¼ in. plate. Tell us your requirements—we'll be glad to quote.

LEE

LAKE ERIE ELECTRIC MFG. Inc., Erie, Pa.



Graphic Control Panel, used with water treating equipment. Totally enclosed, ¼ in. steel plate, rear access door. Wired and tubed for pneumatic operation.

Heat Treating Furnace Control Panel, to IIC specifications. Wiring in bakelite type channel facilitates field changes. Includes various types of relays, timers, fire eye control units, starters, pushbuttons, pilot lights, etc.

Transistorized high speed analog-to-digital **converter** with speed of 6,000 independent conversions per sec operates at 100,000 bits per sec rate. Unit has ± 0.05% accuracy at full scale and 5-v minimum full scale. —Fischer & Porter Co, 641 Jacksonville Rd, Hatboro, Pa.

Pressurized dry chemical **extinguishers,** in 20 and 30-lb sizes for gas, oil and electrical fires contain non-toxic power which will not corrode, freeze or conduct electricity. It delivers 15 to 20 ft stream over a 60-deg arc.—Pyrene-C-O-Two Div, Box 750, Newark 1, N. J.

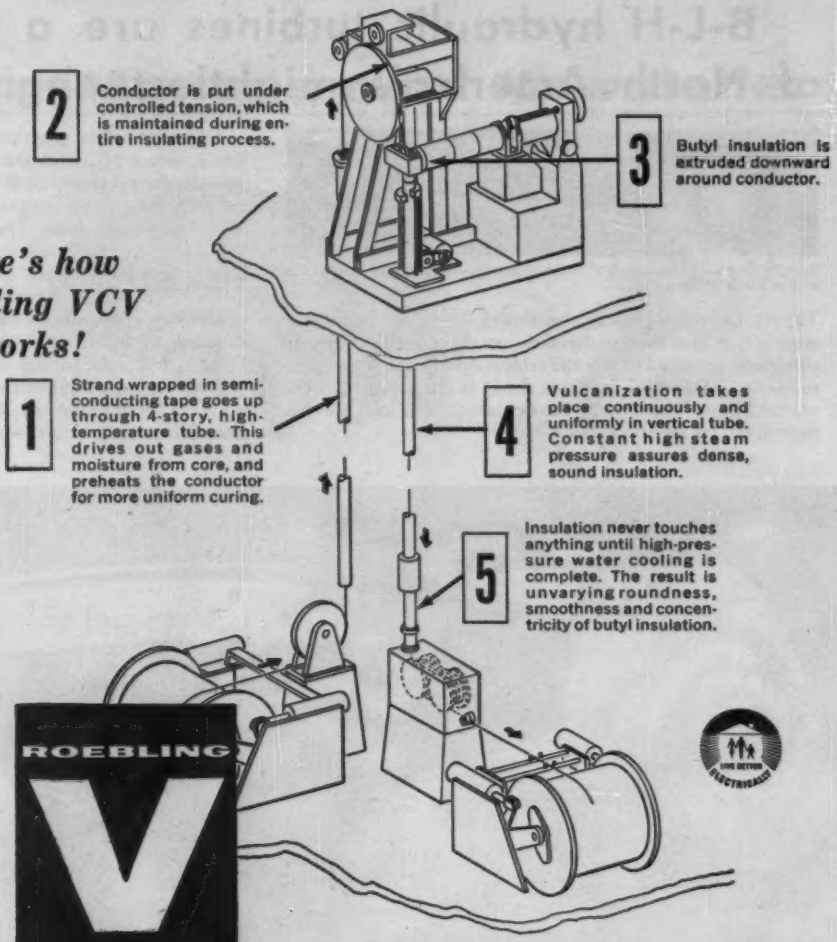
Small, 14-lb, self-contained **camera** for closed circuit TV transmits images up to 1000 ft for use in materials handling, plant security surveillance, and traffic control. Minimum system consists of camera, cable and f2.5 lens. Deluxe models offer automatic movement of both camera and lens.—General Electric Co, Schenectady 5, N. Y.

Model DM electro-magnetic disc **brake** incorporating torque ranges from 30 to 7,500 lb-ft is spring set, magnetically released for fail-safe application. D-c operated, it is designed for higher thermal capacity jobs. Spec sheet 1902.—Stearns Electric Corp, 120 N. Broadway, Milwaukee 2, Wis.

Dual frequency **induction heating generator** has ranges of 250 to 600 kc and 2 to 5 Mc; rated output is 10 kw.—Lepel High Frequency Laboratories Inc, Woodside, N. Y.

All-vinyl **wire marker** only 5-mils thick provides permanent wire identification in oily and solvent-laden atmosphere. Self-adhesive, it clings tightly to plastic insulated wires and withstands temperatures up to 300F without discoloration.—W. H. Brady Co, 727 W. Glendale Ave, Milwaukee 9, Wisc.

Potting compound F-460 offering extreme hardness and —80 to +450F range is poured cold, cures in about two hours at room temperature, and offers less than 1% cure shrinkage. Compound has good dielectric strength and low water absorption factor. Catalog 460.—Dept 334, Carl H. Biggs Co, 2255 Barry Ave, Los Angeles 63, Calif.

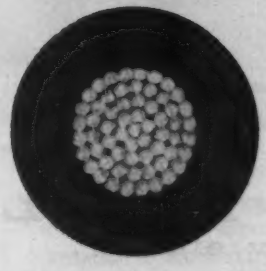

2
Conductor is put under controlled tension, which is maintained during entire insulating process.
3
Butyl insulation is extruded downward around conductor.
1
Strand wrapped in semi-conducting tape goes up through 4-story, high-temperature tube. This drives out gases and moisture from core, and preheats the conductor for more uniform curing.
4
Vulcanization takes place continuously and uniformly in vertical tube. Constant high steam pressure assures dense, sound insulation.
5
Insulation never touches anything until high-pressure water cooling is complete. The result is unvarying roundness, smoothness and concentricity of butyl insulation.

Here's how Roebling VCV works!

The Conductor is Always Dead Center

ROEBLING

VCV



ROEBLING'S 15 KV CABLE HAS UNIFORMLY HIGH CORONA LEVEL AND DIELECTRIC STRENGTH. VERTICAL CONTINUOUS VULCANIZATION ASSURES UNUSUALLY LONG TROUBLE-FREE CABLE SERVICE.

If you sliced a length of Roebling's VCV 15 kv Cable into cross sections, you'd find that *every inch* is uniform, every inch is round, and in every inch the conductor is exactly centered!

VCV is responsible for the exceptional quality of this new high-voltage cable. No longer will you buy cables in which the conductor has "snaked," or that has flattened, scraped, blistered or abraided insulation. Because insulation is the same thickness and density for the length of the cable, dielectric strength and corona level are uniformly high.

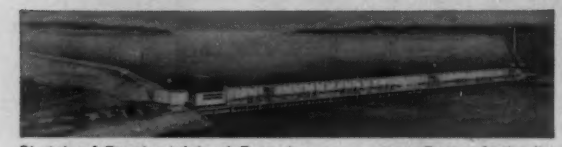
ROEBLING VCV 15 kv CABLES are available in a complete range of conductor sizes and insulation thicknesses

Write today for more facts about the longer, better service you'll get with Roebling VCV High-Voltage Cable. Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

B-L-H hydraulic turbines are a vital part of North America's mightiest engineering feat

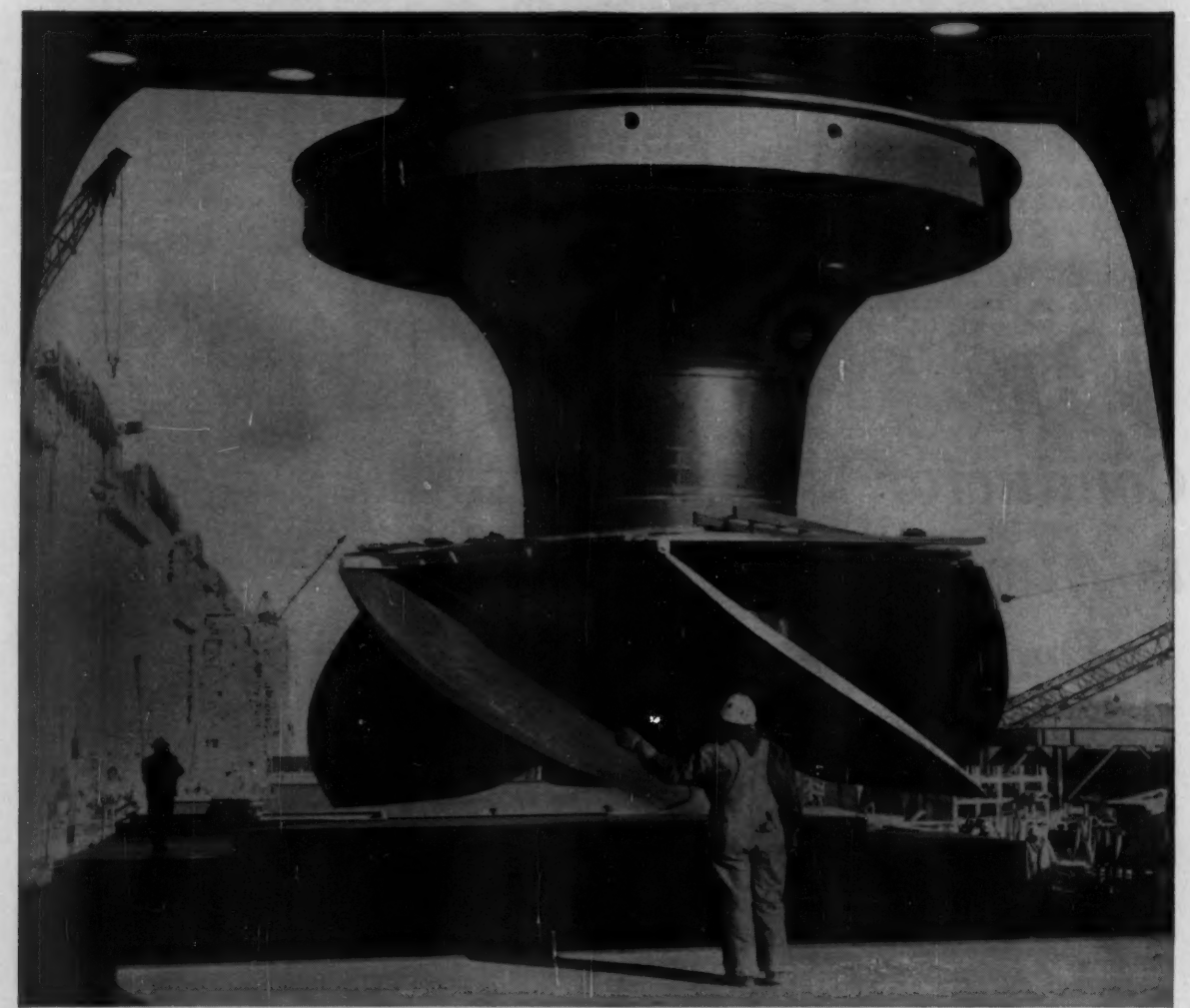


Sketch of Barnhart Island Powerhouse, courtesy Power Authority of the State of New York.

The St. Lawrence Seaway and Power Project is the largest engineering feat ever undertaken on the North American continent. Involved in it is the relocation of main highways, railroads, navigation facilities, and, in certain instances, entire towns. The Power Project alone will call for 86 million cu. yd. of excavation.

All power will be generated at the Barnhart Island Powerhouse, where deliveries are now under way on an order for eight Baldwin-Lima-Hamilton fixed blade propeller turbines. Each of these giants is rated to produce 85,000 hp at 94.73 rpm under 81-ft. head. The last of the eight B-L-H units for this enormous Canadian-American undertaking is scheduled to be completed and ready for shipment in Dec. 1958.

The St. Lawrence Power Project is only one of the many hydroelectric operations throughout the world that have called upon B-L-H's 130 years' experience in designing and building hydraulic turbine equipment. For specific information about our products and services, write to B-L-H Corporation, Philadelphia 42, Pa., or Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.



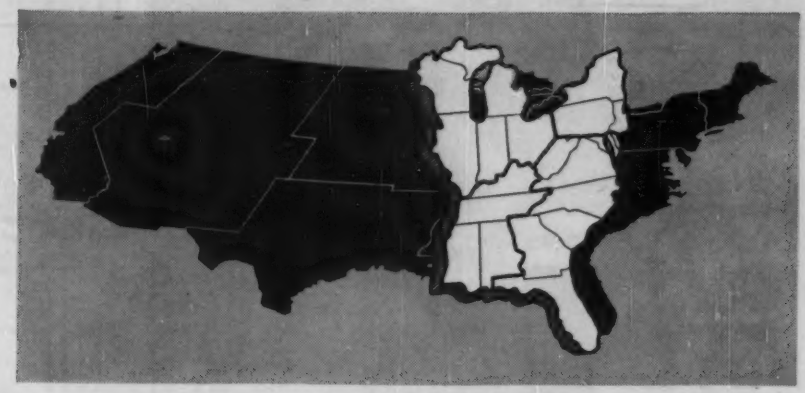
Installation at the St. Lawrence Power Dam, Barnhart Island, N.Y., of a fixed blade propeller turbine runner built by B-L-H's Eddystone Division. Photograph courtesy Power Authority of the State of New York.

BALDWIN · LIMA · HAMILTON

Eddystone Division

Philadelphia 42, Pa.

Hydraulic turbines • Weldments • Dump cars • Nonferrous castings • Special machinery • Bending rolls • Machine tools



Report on
Fuel Outlook II

Where Coal Is Already the King

In four regions of the U. S., coal is already undisputed king of utility fuels. It accounted for 79% of 1957 total generation in South and Middle Atlantic, East South and East North Central regions. By 1975, coal's share should reach 91%, while its fossil fuel competitors dwindle in importance.

Market structure favors coal. Gas and oil are premium fuels. Utilities bid for their use against high-grade fuel oils and residential heating, and take the leftovers from these more profitable markets. On the other hand, the coal industry depends primarily on the utility industry for its market.

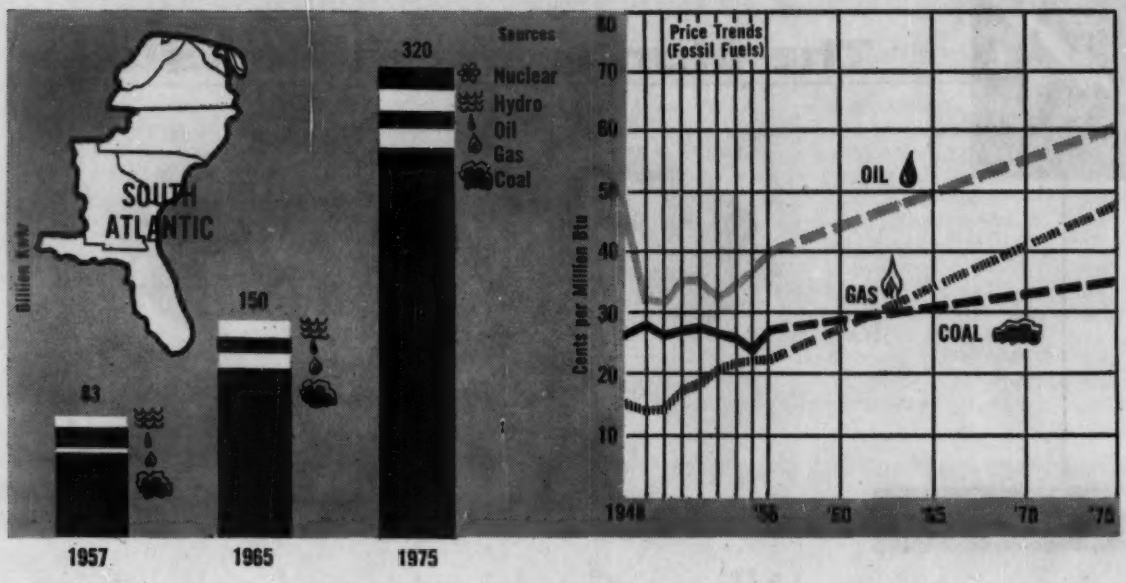
The coal industry is also in a better position to absorb rising production costs than the other fossil fuels. According to McGraw-Hill's "Coal Age," output per man-day for all coal mines rose from 7 tons in 1947 to 11 tons last year. And by 1965, 16 tons per man-day is within reach. Hypothetically, this means that miners' daily wages could move up from the 1957 figure of $22.45 per day to $32.64 per day in 1965 without pushing labor costs up one cent.

Transportation costs will rise; but coal, as the railroads' best customer, already bears much of their burden of rising costs. It is unlikely that freight rates on coal will go up as much as other freight rates. Meanwhile utilities are working on more economical ways to get coal's Btu's to market—both by moving coal and transmitting power from mine-mouth plants.

A big cost problem for the coal industry is raising capital to develop and mechanize its mines. One coal man estimates the industry must raise $2 billion in the next ten years through long-term debt and equity financing.

I. South Atlantic: Coal Moves into Florida

Utilities here will burn more than four times as much coal in 1975 as they do today. Large coal deposits lie in the northern part of the region, and barge transportation to the south will help hold costs down. Florida, the last stronghold of oil in the region, is already feeling the impact of coal. Until now that state has consumed 90% of the oil reported used in the area, but oil use in Florida has



already reached its peak. One Florida utility is building a coal-fired plant, and others are seriously considering coal as a fuel. J. R. Forsythe, general manager of "Keystone Coal Buyers Manual", said last summer: "Developments show that Florida's utilities already plan to burn 2 million tons (of coal) a year by 1961, with a potential of another 10 million."

Coal already accounts for 67% of the energy produced in the South Atlantic region. By 1975, coal's share is likely to be up as high as 83%. Use of gas will get a temporary boost from a new pipeline into the area, but this will have little effect on the long-range picture.

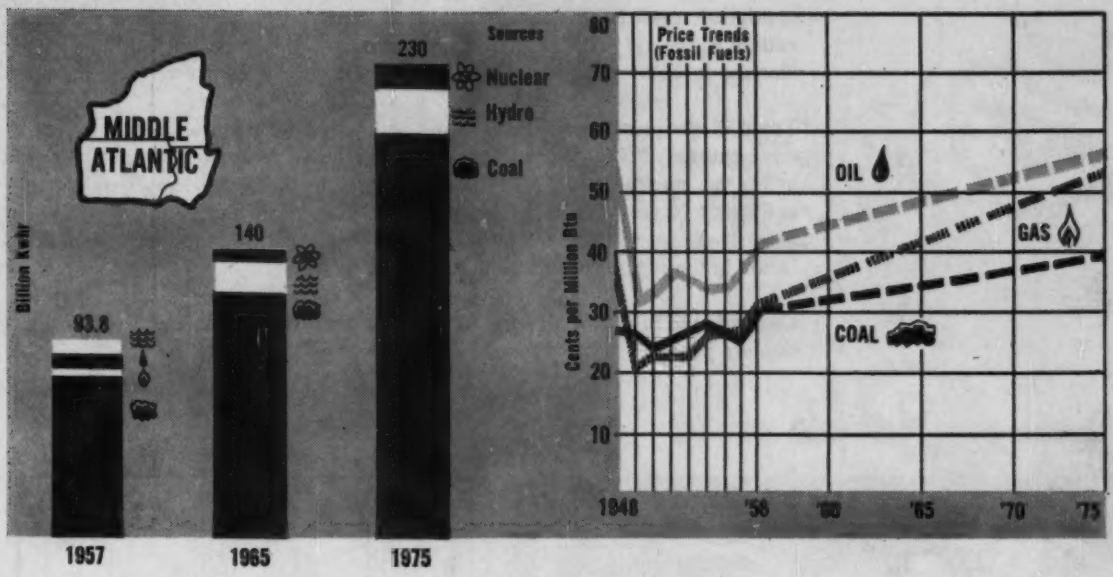
Price trends favor coal. From 1948 through 1956 coal prices in South Atlantic region remained constant at about 25.5¢ per million Btu. Oil prices increased about 20% after a sharp drop in 1949. Gas prices are up about 30%.

Oil and gas prices are likely to keep rising with few pauses. On the other hand coal prices continue to remain stable. In 1957 the price of coal in the South Atlantic region increased slightly. In Virginia it decreased by 1%.

II. Middle Atlantic: Oil and Gas Are Bowing Out

Oil and gas will become insignificant as boiler fuels as early as 1965 in the Middle Atlantic states. By 1975, hydro will account for about 22 billion kwhr in the region, and another 10 billion kwhr will come from nuclear plants. The remaining generation, some 198 billion kwhr, will be coal fired. Gas now provides about 11% of fuel requirements in summer, but the proportion decreases to 1% during the winter as the heating load comes on. The amount of gas burned under utility boilers in summer will decrease steadily as facilities are built to store the gas for winter residential use.

Oil has already lost its place in the long range picture. Although Federal Power Commission reports reveal that 46% more oil was burned by utilities in the Middle Atlantic region last summer than in the summer of 1956, this statistic can be put down to a pricing fluke rather than a long term trend. Consolidated Edison Co of New York notes that oil is no longer considered a base long-range

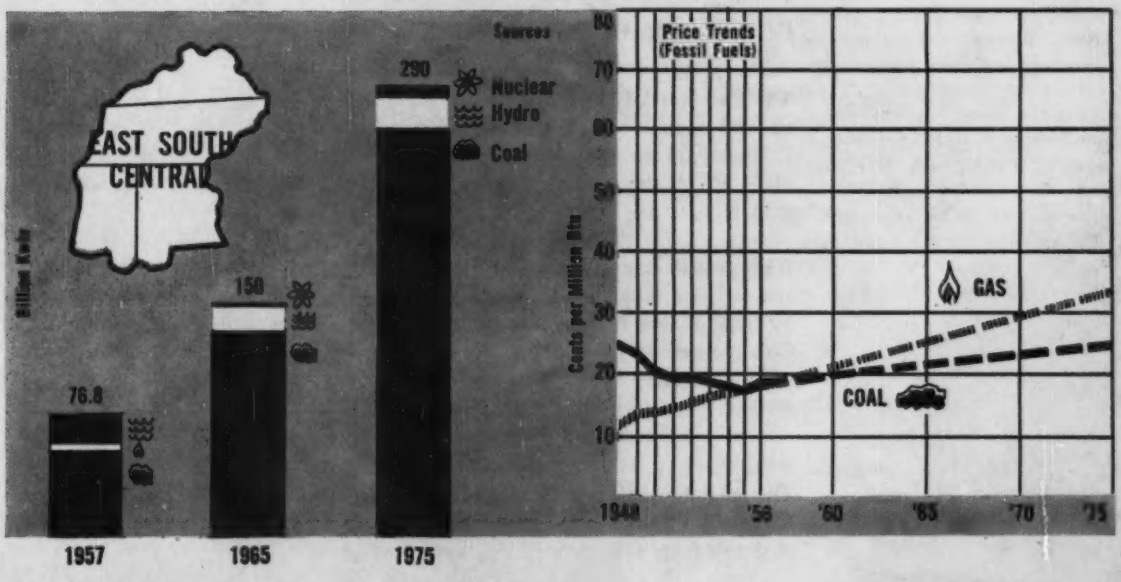


fuel, and the company's newest plants are aimed at full coal operation even though this requires costly precipitators to cut air pollution.

Coal from the western part of the area is transported primarily by rail and by collier, although there is some mine-mouth generation in the coal fields. For the eastern load centers, transmission is not considered feasible, owing to the difficulty of running lines through suburbs and into metropolitan areas.

III. East South Central: Sevenfold Gain in Seven Years

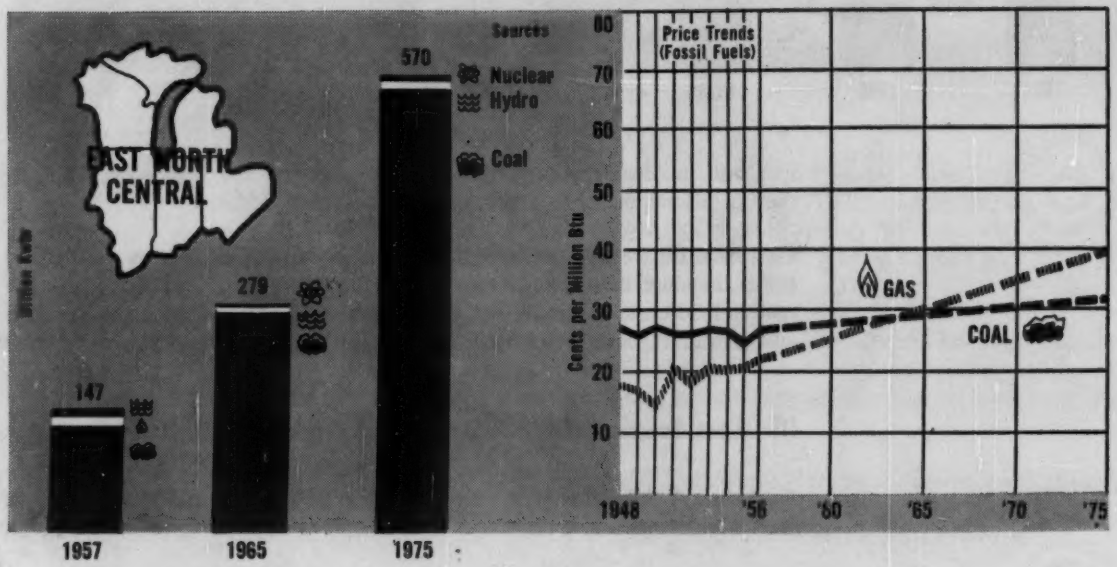
Coal is way out in front in the East South Central Region, and it will widen its lead in the years ahead. In the period from 1951 to 1957, generation by coal



multiplied seven times. And the price of coal dropped from 25¢ to 19¢ per million Btu. Last year there was a 6% increase in Alabama, but less than a 1% increase in Tennessee. For 1958 little price change is expected.

Trend of gas prices is up, but this has little effect on generation since gas now represents only 7% of total fuel use. Hydro furnishes less than 25%. Neither gas, hydro, nor nuclear power will contribute much to the area energy requirements in the next 20 years. Coal at 19¢ has a big edge on everything else. If gas is available, it will not compete for long in price. Hydro will no longer be a significant factor in the region, as it was prior to 1952.

Coal is found in almost all parts of the area. Both barge shipment and transmission are possible.



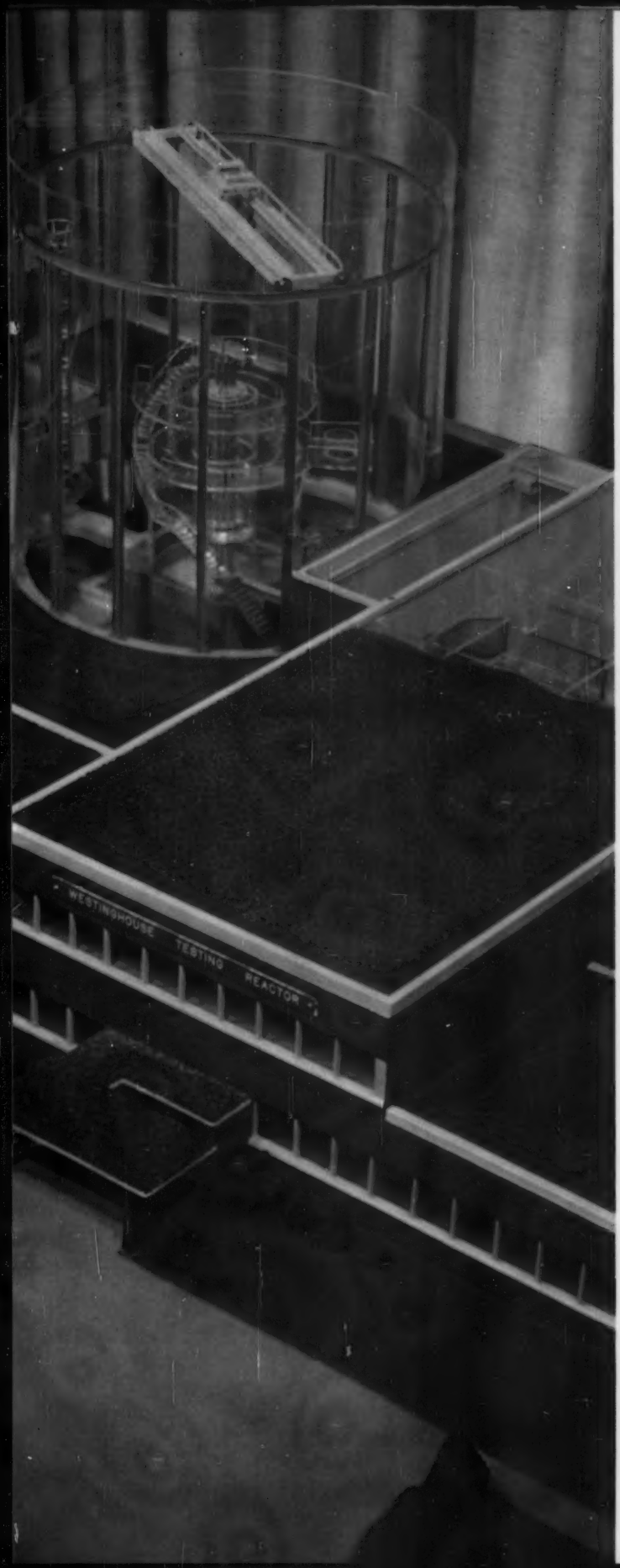
IV. East North Central: No Challengers

The East North Central Region has an abundant coal supply, on which its utilities will undoubtedly depend for the foreseeable future. Use of gas in this region is already on the downgrade. In Illinois, its use as a boiler fuel reached a peak of 21.5% of the total electric energy generated in 1952. It now stands at less than 8% of the total.

High growth rate of the region has fostered many modern plants, virtually all coal-burning. Coal transportation problem is being met partly by barging, partly by transmission from plants near coal mines. Cleveland Electric Illuminating Co's 108-mi coal pipeline also shows promise. Price competition from other fuels will be relatively unimportant during the period under study.

• • •

The most dramatic growth of coal is coming in other regions. Next week's newsletter will discuss future fuel trends in the other five regions of the U. S.—where coal now faces stiff competition from other fuels.



New testing reactor speeds atomic power to industry

ANOTHER EXAMPLE OF EARNINGS PLOWED BACK

This center for testing atomic fuels and core materials will speed benefits of nuclear-generated electric power to utilities and industry.

Thirty miles southeast of Pittsburgh lies an 850-acre tract on which the future of electric power is being strengthened. The advanced facilities and techniques being perfected there will serve and benefit all of American industry through the advance of technical knowledge and experience.

The Westinghouse Testing Reactor, to be completed early in 1959, will provide the equipment and environment for testing, under actual conditions of radiation, temperature and pressure, materials and fuels needed for generation of atomic electric power.

Adjacent to the Testing Reactor is the Reactor Evaluation Center, now in operation. Here, core designs and fuel elements for nuclear-fueled electric power plants are evaluated for criticality and proof of design. Core design tests for Yankee Atomic Electric Company's fuel elements are now underway.

Here, and elsewhere, Westinghouse resources of experience, research and development are continuously at work for all producers and consumers of electric power.

YOU CAN BE **SURE**... IF IT'S

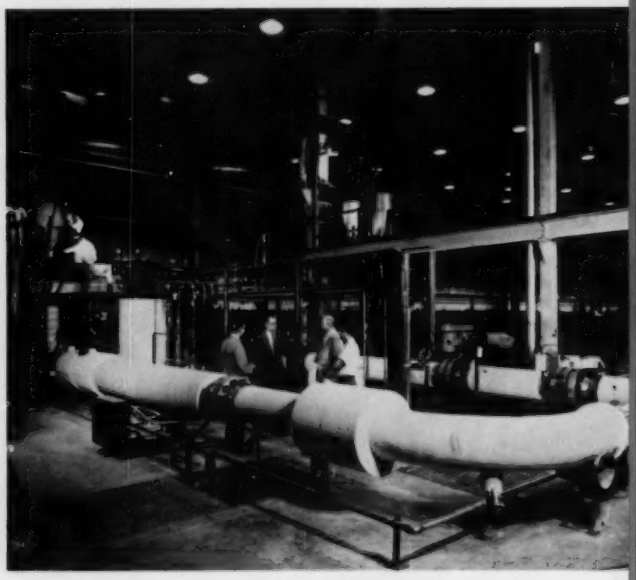
Westinghouse

Westinghouse nuclear testing facilities open a new era in research and development

More than 20 years ago, Westinghouse scientists designed and built the first industrial "atom-smasher" and pioneered a host of developments which have helped make the Atomic Era today's reality. Coupling technical resources and experience with cooperation, Westinghouse and the electric utility industry are making tremendous strides in the development of nuclear-generated electric power. JI-97231-2

The critical experiment room of the Westinghouse Reactor Evaluation Center, where actual evaluation of fuel elements and nuclear core designs takes place. Here, core designs for the Yankee Atomic Electric plant are being tested for criticality, temperature coefficient and other nuclear characteristics.

These facilities and techniques will put nuclear-generated kw's into power lines sooner . . . an outstanding example of Westinghouse policy of putting earned dollars to work in research and development—for *you*.



Westinghouse and Pennsylvania Power & Light Company are presently engaged in design study of the Pennsylvania Advanced Reactor project—an aqueous homogeneous reactor which is fueled by a slurry of uranium and thorium oxides suspended in water.

Components in this slurry test loop approach the size of those which would be used in the actual plant. Construction and testing such as this enables Westinghouse and PP & L engineers to resolve major design problems during the development program.

YOU CAN BE SURE...IF IT'S Westinghouse

Watson Takes Mississippi Power Co Helm

A. J. Watson, Jr., has been named president and chief executive officer of Mississippi Power Co. He succeeds L. P. Sweatt, who has been made chairman of the board and an adviser and consultant to the president.

Watson comes by the presidency as a logical step in a long one-utility career that has been characterized, as one subordinate puts it, "by no pet peeves or ulcers." He started working for MPC in the summer of 1926 as a student engineer while attending Mississippi State College. He worked the following three summers and joined the utility permanently in 1930. His rise through company ranks thereafter ran the gamut from clerical duties in the commercial department (1930) to director.

The new president is looking forward to his job "as a challenging assignment . . . perhaps the most interesting and rewarding of my career." He sees two principal spectres haunting the investor-owned electric utility business: the expansion of public power and the ability to finance the tremendous expansions necessary to provide the best possible customer service.

A minimum nine-to-ten-hours-a-day man, plus more than an occasional weekend, Watson relaxes with his wife and two children on the family boat. "But I don't get to do it as often as I'd like." He encourages MP employees to participate in outside activities, and sets a good example with his own memberships in the Chamber of Commerce, Gulfport Rotary, and the Masons.

A. J. WATSON, JR.

Zimmerman and Keele Get Sales VP Posts

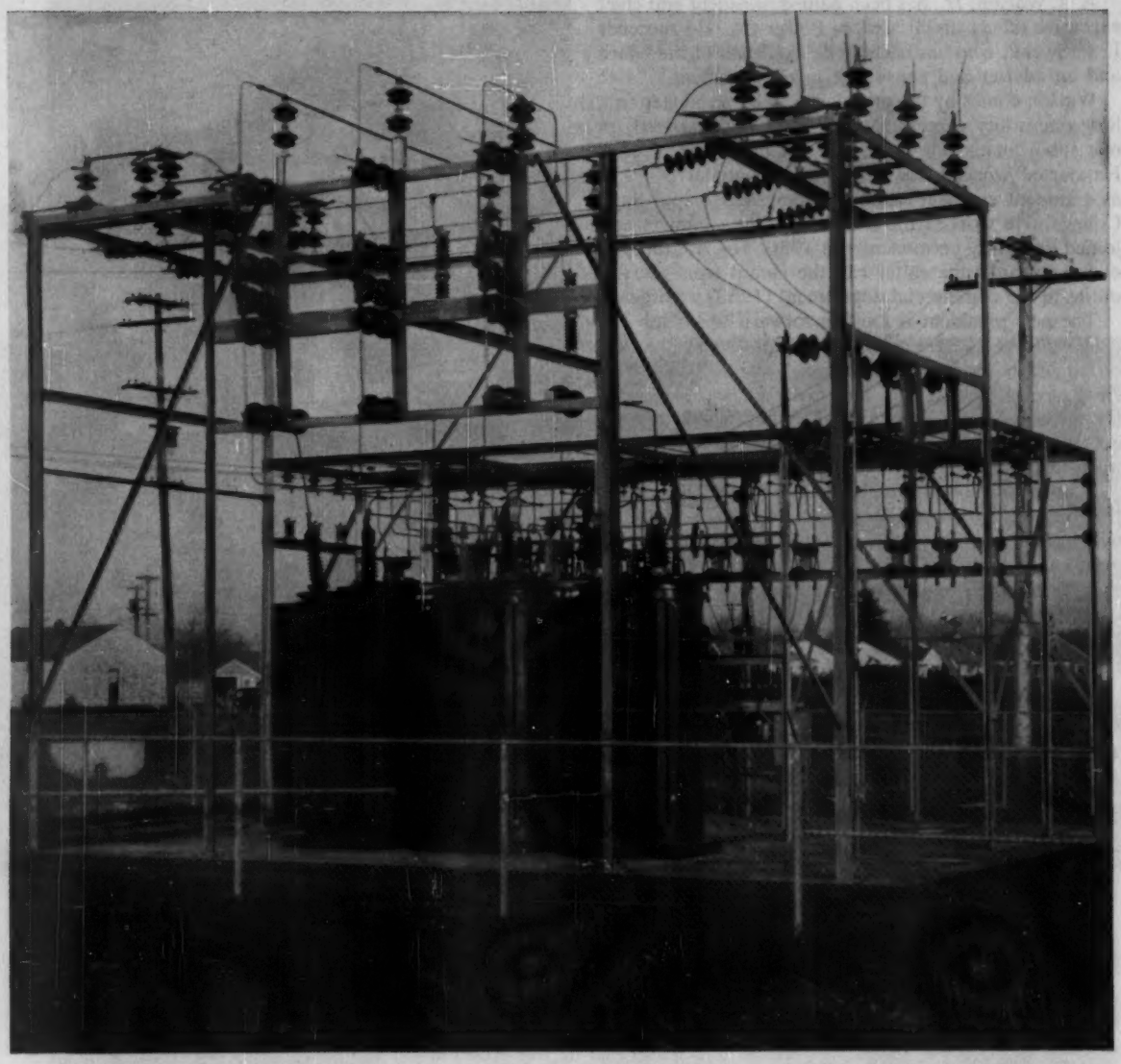
ZIMMERMAN

◀ Robert K. Zimmerman has been elected vice president of Kansas City Power & Light Co. Zimmerman, former general sales manager, will handle sales, area development and customer services. The new vice president is a Rutgers University graduate. He came to Kansas City P&L in 1950 as supervisor of employee education; prior to that he was with Public Service Electric & Gas Co.

J. H. Keele has been named vice president of Florida ▶ Power & Light Co in charge of sales promotion activities. In making the announcement, FPL President and General Manager R. H. Fite pointed out that the utiilty has won several top national awards under Keele's supervision. Keele started his career with FPL in 1926, and has risen steadily through the ranks ever since.

KEELE

NOW! THE INSTALLED COST OF AN



THE INSTALLED COST of this aluminum substation structure was actually less than steel. Public Utility District No. 1 of Cowlitz County, Longview, Washington. O. G. Hittle, Manager; Donald Hughes, Chief Engineer.

KAISER ALUMINUM supplies leading fabricator-erectors with high quality American standard extruded angles, channels and "I" beams. We will be happy to refer you to substation structure fabricators who are ready to quote realistic prices on aluminum.

ALUMINUM SUBSTATION STRUCTURE IS THE SAME AS STEEL!

COST OF ALUMINUM VS. GALVANIZED STEEL SUBSTATION STRUCTURES*

	3 ALUMINUM STRUCTURES BOLTED CONSTRUCTION Weight: 19,900 lbs.	3 STEEL STRUCTURES BOLTED CONSTRUCTION Weight: 59,700 lbs.
Total Installed Cost of Structures	$15,186	$17,313
Cost per pound of Structures, Installed	76¢	29¢

*Based on cost figures for 69/12.5 KW aluminum substation structure as compared to an equivalent galvanized steel structure. All work was performed by the utility.

Note in the figures above that the installed cost of the three aluminum structures is actually *less* than steel. Savings were principally realized through lower fabrication and erection costs. For most aluminum structures, installed costs are about equal to steel. *But here the equality ends!*

A BONUS! NO MAINTENANCE!

The high maintenance costs of steel keep mounting as long as the structure stands. Steel structures in corrosive areas require two coats of paint every five years to prevent rust and corrosion. Costs of rehabilitating a steel structure can run as high as 5 to 12 cents per pound of structure.

On the other hand, aluminum structures can't rust, resist corrosion, never need painting—maintenance costs are eliminated. *You pay nothing above the installed cost of the structure.*

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New 48-page booklet fully explains the many advantages of aluminum, offers complete design information. Mail the coupon now!

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For immediate service, contact the Kaiser Aluminum sales office listed in your telephone directory. Or write: *Kaiser Aluminum & Chemical Sales, Inc., Dept. EW-1, 919 North Michigan Avenue, Chicago 11, Illinois.*

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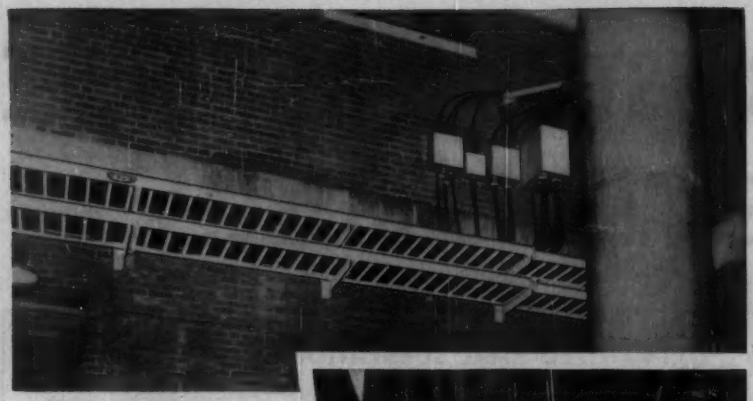

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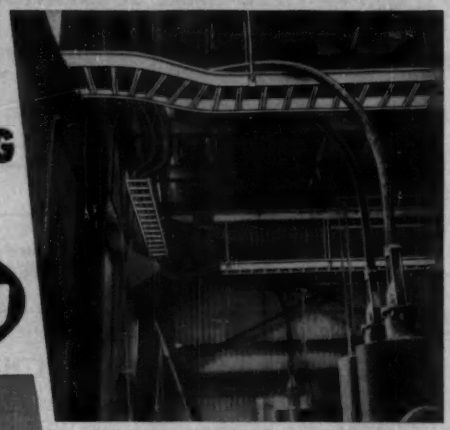

A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.

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GALVANIZED • NO MAINTENANCE PROBLEM

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Write for new complete catalog. Distributors in all principal cities. Contact the Grip-Strut distributor under "Conduits" in the classified telephone directory.

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IP&L Ups Switzer

The recent election of George F. Switzer to the post of assistant vice president has been announced by Indianapolis Power & Light Co.

Switzer was promoted to this new position after having served the company as chief engineer since January of 1950. He has been with IP&L since his 1932 graduation from Purdue University with an electrical engineering degree.

Empire Names PA

Julius S. McAdams has been named to succeed Roy Aikin as head of the purchasing department and storerooms of The Empire District Electric Co.

McAdams, assistant purchasing agent since 1951, has spent most of his 18 years at Empire in the utility's purchasing department. Aikin, his predecessor, retired on April 30 after almost 41 years of service with the company.

Sloan is President

The new president of Crouse-Hinds Co is Robert J. Sloan. He was elected to replace J. R. Tuttle who continues as chairman of the board of directors.

In addition, Raymond W. Cummings was elected secretary.

Sloan, executive vice president since 1956, began his career with the company in 1923 while a student at Cornell University. In 1951 he became secretary and a director.

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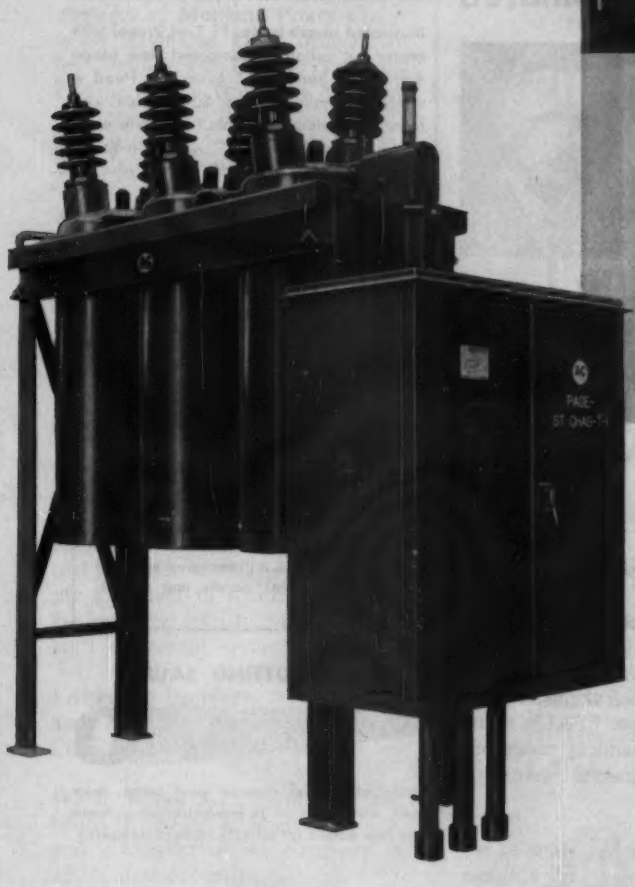

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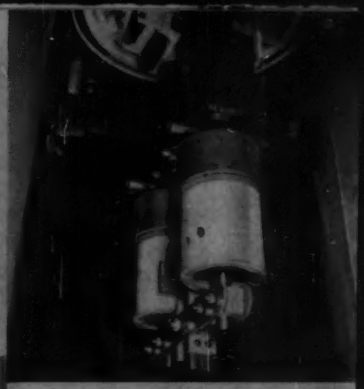
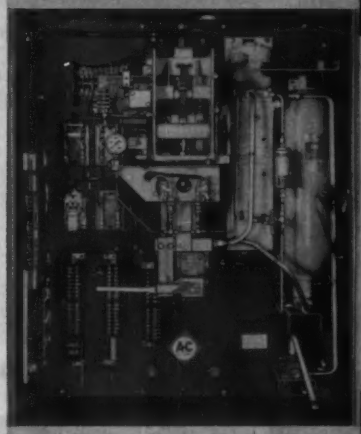
Fast contact opening and closing proved by time and laboratory tests. *Turbo Ruptor* device features bayonet and segmented tulip for wiping action, positive contact and absorption of mechanical impact.





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Simple design, with few moving parts . . . the *Pneu-Draulic* operator offers many advantages. Dust, dirt, moisture, heat and cold are no problems. Field-proved in dozens of utilities.

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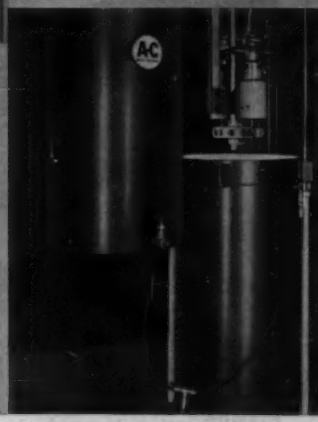
Full access to tanks and contacts unobstructed by framework. In addition, optional power-operated hydraulic tank lifter eliminates hand cranking, makes it safe and easy to lower and raise tanks.



Allis-Chalmers large frame-type breakers have many quality features

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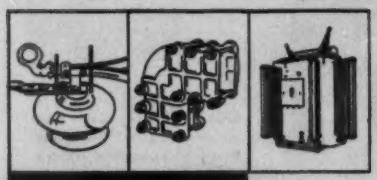

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Milliken Advances

Kennecott Copper Corp has named Frank R. Milliken as executive vice president. He has been vice president of mining operations since 1952.

A graduate and former faculty member of Massachusetts Institute of Technology, has held various technical and operating positions in the mining industry. He was 1952 recipient of the Robert H. Richards Award of American Institute of Mining, Metallurgical and Petroleum Engineers.

Neumann Promoted

Wencel A. Neumann, Jr, was recently elected as president of both De Laval Separator Co and its West Coast subsidiary, De Laval Pacific Co.

Prior to this promotion, he had been executive vice president-manufacturing for the parent company since 1954. He had previously served with De Laval Steam Turbine Co as vice president-industrial sales and as controller.

PERSONAL BRIEFS

Eugene F. Machell, formerly production manager for Portland Gas & Coke Co, has joined Pacific Power & Light Co as chief chemical engineer and will direct PP&L's activities related to chemical processes, including development investigations.

Peter J. McTague has risen to assistant vice president of Citizens Utilities Co . . . At Public Service Electric & Gas Co, **Malcolm Carrington, Jr,** has been elected assistant secretary.

Illustrated above is No. 11 Tree Pruner with center cut action by tempered steel blade that easily handles 1" branches. Head is reinforced malleable iron. Spruce poles with telescoping aluminum joints. For heavier work No. 12-18, capacity 1½". Also Pole Saws.

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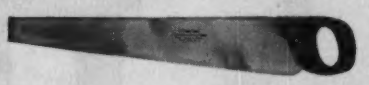
Hand forged throughout. Fast and easy double cut action with thin blades shaped to "draw in." Improved bolt and nut joint, through handle and riveted grip fastening.

FAST-CUTTING SAWS



Blades of Swedish charcoal steel. Large, deep teeth with heavy set to prevent binding. Hand and Pole models for all work up to chain sawing.

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Recent promotions in New England Electric System and subsidiaries include: **George F. Ringler,** to treasurer of Narragansett Electric Co and Mystic Power Co, and assistant treasurer of Attleboro Electric Co; **Richard J. Lyman,** to executive assistant in Boston, reporting to System VP Ralph E. Nock; **Fritz A. Ohrn,** to treasurer of New England Power Service Co; and **Howard E. Needham** and **Walter W. Werner,** to assistant treasurers, New England Power Service.

American Institute of Electrical Engineers has elected these members to the grade of Fellow: **Fred T. Bear,** of Delaware Power & Light Co; **Ingolf B. Johnson,** General Electric Co; **Fremont L. Roe,** Salt River Power District; **Victor E. Schlossberg,** Inland Steel Co; and **Charles H. Titus,** GE.

J. E. Corette, president and general manager of Montana Power Co, is again serving as U. S. delegate to the Committee on Electric Power for Europe, which convened May 19. The committee is a subsidiary organization of the United Nations Economic Commission for Europe.

Armor B. Martin, research consultant of Washington Water Power Co, has been named as assistant vice president.

Albert L. Sklar has been appointed a member of the Maryland Public Service Commission, succeeding Frank Harper, deceased.

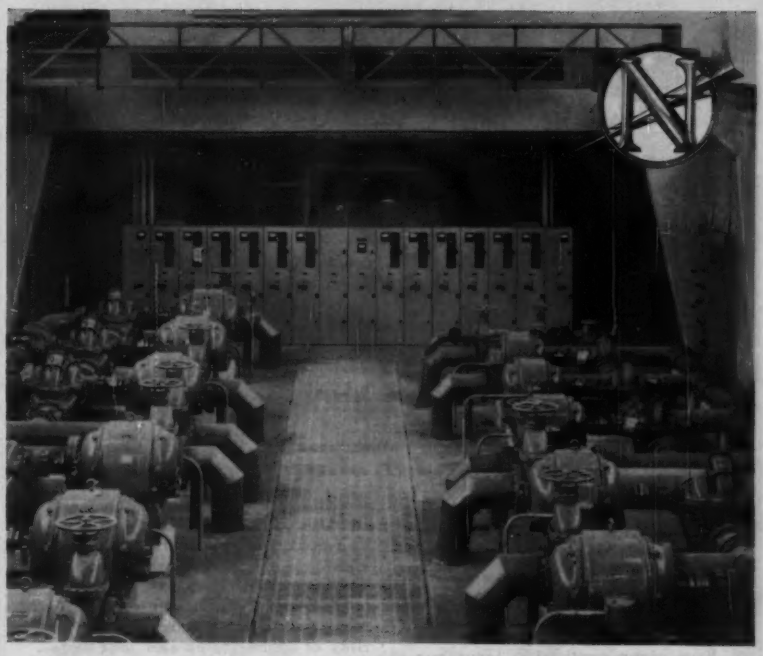
OBITUARY

Ralph C. Boozer, retired secretary and treasurer of Joslyn Mfg & Supply Co, died in Chicago recently. He had been with Joslyn from 1912 until retirement several years ago.

Edwin K. Ilgenfritz, 68, secretary and treasurer of Florida Power Corp, died recently in Atlanta.

W. J. Mann, Jr, chairman of the board of Wolfe & Mann Mfg Co, and a founder of the company in 1922, died recently.

A. Scudder Moore, 71, retired general superintendent of the Brockton (Mass.) Edison Co, died in Brockton.



Nelson 2300 volt motor starters provide electrical control of pumping operations at Park Cities Water Treatment Plant, Dallas, Texas.

Over 7 years . . . Over 57,480 hours Continuous Operation!

That is the history of the 2300 volt Nelson Motor Starters in the Park Cities Water Treatment Plant, Dallas, Texas.

During these 7 years, only routine maintenance has been required. Needless to say, the owners are extremely well pleased and have ordered additional Nelson equipment.

Performance records such as these are the reasons why more and more Nelson quality-built electrical control equipment is being specified.

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for double assurance of quality

—Another Progressive Step by PAGE!

• Top quality of materials has always been a distinguishing feature of PAGE Chain Link FENCE. This well-known value plus PAGE standards of workmanship in fence erecting by members of the Page Fence Association have given continuing assurance of reliable protection and good appearance. Now another forward step adds to value certainty. Each newly erected fence will be identified by a PAGE "REGISTERED" metal plate and a dated, numbered and signed Registration Certificate will be given to the owner. Registration of your new Page Fence and certification of its quality are assurance of long, dependable service and lasting satisfaction.

PAGE will help you to choose the RIGHT fence for YOU from a wide variety of fence styles and four superior fabric materials—including the new ACCO Aluminized Fabric. For information and name of nearest Association member, write for Folder DH-26.

Address: PAGE FENCE ASSOCIATION
National Headquarters • Monessen, Pa.

A PRODUCT OF PAGE STEEL & WIRE DIVISION, AMERICAN CHAIN & CABLE COMPANY, INC.

We're busy as a one-armed paper hanger—making

SUPERIOR EQUIPMENT for the UTILITY INDUSTRY

but we will never compromise with quality

SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company

Socket Equipment • Test Switches • Test Blocks • Enclosures • Test Tables

Sighting for Sagging

(*Continued from page 54*)

tions, or over rough terrain or heavy angles, it is sometimes necessary to adjust the wire up and down several times before correct sag is obtained in all spans. This difficulty is aggravated when friction sheave is excessive. Close attention to care and maintenance of sheaves pays dividends.

Where number of control spans is limited, and the rear end of the section is a clipped suspension structure rather than a deadend, an observer should check position of the insulator string at the clipped structure. This gives a rough sag check. If tension in the section being sagged is the same as in the previously clipped section, the insulators should settle in the vertical position in which previously clipped. Here again, work should progress from the rear forward, checking the last clipped insulator string plumb before attempting to bring the control span ahead into sag.

If a rough visual check after final sagging is satisfactory, a precise transit check by vertical angle may be employed. As in actual sagging, a sighting point is chosen at a distance, T, below conductor support on one structure. Again, T should be selected close to the prescribed sag for the span.

Allowance must be made for precise difference of elevation between supports, by measuring angle n (Fig 7). Angle m (Fig 6) is measured. Then

$$t = A\ (\tan n - \tan m), \text{ and}$$

$$S = \left(\frac{\sqrt{T} + \sqrt{t}}{2}\right)^2$$

Comparison of the value of S, obtained by this check with required sag, indicates precision obtained. The error, if any, may be expressed as a percentage of the required sag. A tolerance of $\pm 1\%$ usually is allowable.

Corn Cobs Clean Windings

The lowly corn cob is helping Army Engineers in its biennial overhaul of a Bonneville generator. Used in a sand-blasting machine, the ground cobs offer good cleaning action with little abrasiveness.

NELPA Meets

(*Continued from page 60*)

that existing loading guides are too conservative, Lockie continued. The guides fail to heed higher thermal capabilities of new insulations and minimized stresses.

Total staff at Commonwealth Edison's 180-Mw Dresden boiling-water reactor plant will be about 88 for the single unit, instead of the typical 92 at a two-unit, 220-Mw gas-fired conventional station, said J. A. Haaga, GE. Major differences are double the conventional number of engineers and technicians at Dresden, but only about two-thirds the usual maintenance staff. A utility can estimate that about 1% of a reactor plant's initial cost will pay for training a full staff.

Pre-clearing a hydro reservoir minimizes debris control operating labor and charges. But usually total annual costs are less when modern debris control methods are used and reservoirs not pre-cleared, said C. Arnott, BC Electric.

THIEL NEMA Specification Conventional Type TRANSFORMER HANGERS

HANGER KICKERS IN TWO SIZES FOR "T"-TYPE HANGERS

THIEL HANGERS ARE MADE ACCORDING TO NEMA SPECIFICATIONS. HEAVY STEEL CONSTRUCTION. HOT-DIP GALVANIZED FOR DEPENDABLE SERVICE AND LONG LIFE. FOUR STYLES COMPLETE WITH GALVANIZED BOLTS AND NUTS.

T-TYPE HANGERS In Two Sizes for 3.50 KVA 1-Phase and 9-45 KVA 3-Phase Transformers

IN STOCK FOR IMMEDIATE DELIVERY

THIEL TOOL & ENGINEERING CO., INC.
217 N. MARKET ST. LOUIS 4, MO.

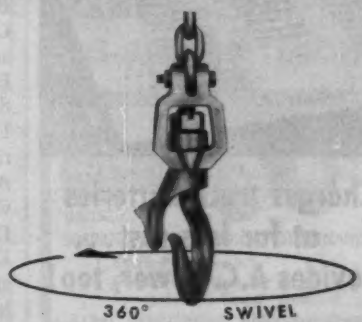
NOW...the "Lineman's Hoist"

ONE-TON

Rated to lift a one-ton load. Proof-tested to 3000 lbs. before shipment. Weighs only 12 lbs.

with an important NEW feature

This popular lightweight, fast-operating hoist now has a 360° SWIVEL hook with a thrust bearing that permits it to swivel freely under FULL LOAD.



...and a New TWO-TON Capacity

Now... a big brother to the popular Chance One-Ton Hoist... a Two-Ton Hoist with the same mechanical simplicity—plus precision gearing that doubles load capacity. Bigger, stronger, it has all the features linemen from coast to coast suggested in helping to develop the Chance One-Ton Hoist.

Easy-to-grip well-balanced handle operates from either side. "Free-wheeling" for ease in hooking to load. Automatic locking prevents accidental dropping of load. Chain won't bind or kink. Half or full link take up. Controls can be worked with gloves. 360° swivel hook with optional safety latch.

SAFETY LATCH HOOK
Optional at slight extra cost.

TWO-TON

Rated to lift a two-ton load. Proof-tested to 6000 lbs. before shipment. Weighs only 24 lbs.

Order from your line equipment wholesaler.

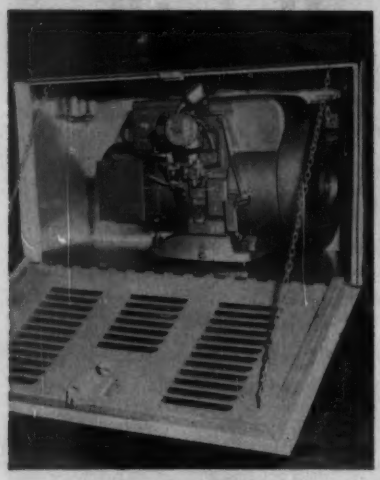
A·B·CHANCE CO·

GENERAL OFFICES: CENTRALIA, MO.
(A. B. Chance Co. of Canada, Ltd., Toronto)

abc IN INDUSTRIES

CT58-8

ELECTRIC PLANT
NEWS



Charges truck batteries at far less cost... provides A.C. power, too!

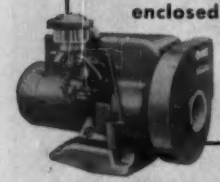
Before the dual-purpose Onan Electric Plant was installed on this maintenance truck, it was necessary to run the 160 H.P. truck engine to charge batteries used for communication. Now, the 2 H.P. Onan Electric Plant does the same job...saving fuel and engine maintenance.

The electric plant is an Onan Model 07AK-1R/972. It has an output of 750 watts A.C. or it can deliver 8 amperes for 12-volt battery charging. Plug-in receptacles are provided for operating electric drills, saws and other equipment used in construction and maintenance work.

Big savings reported!

One utility makes fuel savings alone estimated at $2.00 per day per truck. Another cites an annual saving of $800.00 per truck. This is based on battery charging output only. In addition, the A.C. output makes possible replacing hand tools with electric tools . . . saving time and money.

Vacu-Flo cooling permits enclosed installations



Vacu-Flo cooling is a low-cost optional feature on Onan air-cooled plants up to 10,000 watts.

Other Onan Models: 500 to 150,000 watts A.C., D.C. and Battery Charging

Write for folder showing 3 Packaged Power Systems

Onan
ELECTRIC PLANTS

D.W. ONAN & SONS, INC.
2830A University Ave. S.E., Minneapolis 14, Minn.

SALES ASSIGNMENTS

Arrow-Hart & Hegeman Electric Co has named two new sales representatives. They are Howard Kennedy, who will cover the Houston (Tex.) area; and Harold G. Brennan, Jr, who will cover Louisiana, Mississippi, and Arkansas from New Orleans headquarters.

Baldwin-Lima-Hamilton Corp has added Robert E. Coates to its Eddystone Division staff as assistant sales manager of hydraulic turbines.

Benjamin Electric Manufacturing Co recently appointed three division sales managers: Warren J. Prediger, Eastern Division; D. M. Woodside, for the newly formed Southeastern Division; and Jack A. Chrismer, for the new Southwestern Division . . . Appointed as district representatives were Warren G. Meltzer, Eastern Division, Massachusetts district; David T. Ostrander, Central Division, Ohio district; and Eric W. McCabe, Southwestern Division, Texas district.

Chase Brass & Copper Co, a subsidiary of Kennecott Copper Corp, has advanced Charles W. Baker to assistant general sales manager. With offices in Los Angeles, he will devote his time to the western and midwestern sales regions. Allan R. Armstrong replaces him as western regional manager.

Daystrom, Inc, has designated John D. MacNamara as manager of the New York district for the Weston Instruments Division. He will supervise all sales and district office operations in the New York metropolitan area, including Long Island and Westchester County.

REPRESENTATIVES

Fisher-Pierce Co, Inc, recently appointed J. M. Livingston sales representative for all the firm's accounts in northern Illinois and southern Wisconsin. He headquarters in Chicago.

Hughey & Phillips, Inc, has appointed Maitland K. Smith Co as southeastern sales representative. The latter firm has offices in Atlanta, Ga.; Birmingham, Ala.; Matthews, N. C.; and Clearwater, Fla.

Haley's

CEDAR POLES • FIR CROSS ARMS •

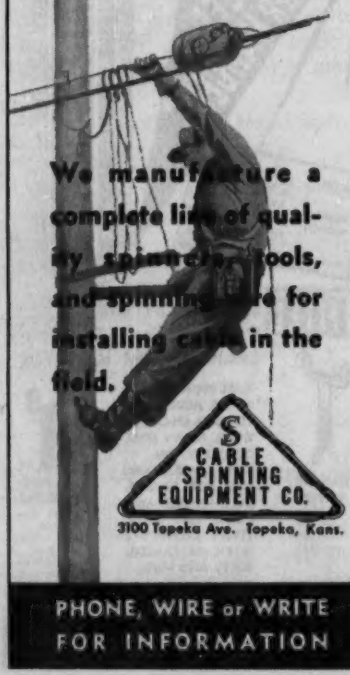
PENTAchlorophenal TREATED—
in our modern plant for protection against decay, moisture and insect damage.

STRONG . . . LIGHTWEIGHT . . . CLEAN

• Two strategically located yards
MINNEAPOLIS, MINNESOTA — FINDLAY, OHIO

R. G. HALEY & CO.
SPITZER BLDG. — TOLEDO 4, OHIO

For
SPINNING CABLE IN THE FIELD



We manufacture a complete line of quality spinners, tools, and spinning gear for installing cable in the field.

CABLE SPINNING EQUIPMENT CO.
3100 Topeka Ave. Topeka, Kans.

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Consulting Engineers
Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction
Investigations, Valuations and Rates
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THEODORE D. BROSS LINE CONSTRUCTION CORP.
Steel Tower & Wood Transmission Lines
Distribution & Maintenance
175 Enfield St. Hartford, Conn.

COMMONWEALTH SERVICES INC.
Management and Business Consultants
300 Park Ave
New York 22, N. Y.

ASSOCIATES INC.
Consulting and Design Engineers
209 E. Washington
Jackson, Michigan

ELECTRICAL TESTING LABORATORIES, INC.
Electrical, Electronic, Environmental, Photometric and Chemical Laboratories. Testing, Research, Inspection and Certification.
2 East End Ave. New York 21. N. Y.

HOOSIER ENGINEERING COMPANY
Erection and Maintenance of Electrical Transmission and Distribution Lines
1350 Holly Ave., Columbus 16, Ohio

M. W. KELLOGG
Piping System Flexibility Analyses
Unique model tester as well as modern digital computer facilities available for low cost, accurate flexibility analyses of the most complex piping systems.
The M. W. Kellogg Company
711 Third Ave., New York 17, N. Y.

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Engineers
Appraisals—Investigations—Depreciation Studies—Cost Trends—Reports
for Rate Cases, Security Issues, Regulatory and Accounting Requirements
Original Cost and Continuing Property Record Determination
Ann Arbor, Michigan

PIONEER SERVICE & ENGINEERING CO.
Consulting and Design Engineers . . Purchasing Specialists in Financing Accounting and other Operations
231 So. La Salle St. Chicago 4

SARGENT & LUNDY
Engineers
140 South Dearborn St.
Chicago, Ill.

TIPPETT & GEE
Consulting Engineers
Mechanical • Electrical • Thermodynamic
Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process
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(Classified Advertising)

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EMPLOYMENT OPPORTUNITIES: $22.07 per inch. Subject to Agency Commission.
EQUIPMENT & BUSINESS OPPORTUNITIES: $16.85 per inch for all advertising appearing on other than a contract basis. Not subject to Agency Commission.
AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.
PROPOSALS. $1.80 a line an insertion.
BOX NUMBERS count as one line additional in undisplayed ads.
DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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Research fellowships. Broad scientific training especially for engineers. $3000 annual stipend. M.S. and Ph.D. degrees granted.

APPLIED SCIENCE,
UNIVERSITY OF CINCINNATI,
CINCINNATI 21, OHIO.

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITION VACANT

Electrical Superintendent—Graduate electrical engineer or equivalent, preferably registered, to take charge of electrical distribution and steam generation for municipal operation in southern Pennsylvania college town of 20,000. Attractive salary, good working conditions, pleasant living, job security, non-political. Send full resume, including references, to P-7697, Electrical World.

POSITION WANTED

Engineer, Power generation and Distribution with Consulting Firm or Utility. Education: B.S. Mechanical Engineer, Registered, extra courses electrical; Experience: Twenty years, diversified in design, installation, operation and maintenance generation and distribution. Present manager and Engineer system 11,000 meters. Age 48, married, three children, good health. PW-7946, Electrical World.

PERIODICAL

A.I.E.E. Transactions wanted to buy for cash. Back volumes and Back Sets. Also other technical and scientific Periodicals. E. W. Ashley, 27 East 21, N. Y. 10, N. Y.

GMC 6x6 NAMED ARMY'S BEST ALL-AROUND TRUCK!

UNUSED!
GUARANTEED! NEW-TRUCK PERFORMANCE!

- **Extra Pull Power!**
- **Double Traction for Mud!**
- **Special "Off Road" Design!**

From Government Storage — these all-wheel-drive GMC 2½ ton 6x6's were specially designed by the U. S. Army to take the roughest terrain in all kinds of weather. These unused 6x6's can do the same for you in all your truck jobs; whether in a muddy field or along a super highway.

Processed — by Memphis Equipment Company — down to the last bolt to assure you of receiving the finest unused GMC 2½ ton 6x6 trucks available today. Parts available anywhere in the nation.

For specifications, prices, delivery, write, wire or phone collect
JAckson 5-7841

DON MERRITT
MEMPHIS EQUIPMENT Company
ARMY TRUCKS • PARTS
CONSTRUCTION EQUIPMENT
766 SO. THIRD STREET • MEMPHIS, TENN.

Your inquiry will have Special value . . .

If you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, it will identify you as one of the men the advertisers wants to reach with this message . . . and help to make possible enlarged future service to you as a reader.

FOR SALE

As a lot or on an Individual Basis

1—100 KW G.M. Diesel Driven Generator complete with switchboard and accessories—in operation.

1—Same as above—except partially assembled and with parts missing.

3—100 KVA, 1 Phase transformers, 6600/2300 Volt.

1—20 H.P., 3 Phase, 220 Volt, G.E. Type K. T. 1145 RPM Induction Motor with type CR-1034 starting compensator.

FISHERS ISLAND ELECTRIC CORP.
Tel. 251 Fishers Island, New York

Readers Forum

Co-op Manager Replies

To the Editor:

In reading a letter to you from Mr. Nickelsen (EW, March 17, p 122), it makes me wonder just how stupid people can get. If he calls his letter an enlightenment to people on the true story of electrification, it is about as poor a publication as I have ever seen. He represents himself as telling the true story about rural electrification and I did not find a single truth in his letter. There are some questions that I would like to ask Mr. Nickelsen and would also like very much to have printed the true answers to them:

(1) Where can I find a rural electric cooperative that has been given anything by the government or anybody else? Rural electric cooperatives borrow their money from the government and repay with 2% interest. Through 1956 the government had made a profit off of this interest in the amount of $57,000,000. Where is the gift?

(2) Why did the electric utilities not accept the government's offer to loan them money at 2% interest and go ahead and build the lines like the rural electric cooperatives did? At how many locations besides the one you mentioned in Iowa did anybody offer rural people electricity for a $4.50 minimum?

(3) I would like for someone to show me any part of their tax deduction from their check that goes to help the rural electrification program.

(4) Where is anybody receiving any free electricity from anybody's electric system?

(5) Why doesn't the ELECTRICAL WORLD print the true amount of tax subsidies or free tax write off given so-called private electric utilities. It's funny this never gets into print. . . .

It was recently ruled that the ECAP ads that were being deducted from tax return were not eligible for deduction because of their nature. What was this nature?

Look out rate payers. You will soon be paying for being propagandized with such material as is found in Mr. Nickelsen's letter.

Lloyd Brinks
Manager
Irwin County Electric
Membership Corp
Ocilla, Ga.

"Liberalized," Please!

To the Editor:

Let me congratulate you on the emphasis given to the term "liberalized depreciation" in Electrical World of December 30, 1957. I am a little late in writing to you about this and the only reason I can give is that I have been extremely busy on more important matters.

You already know of my interest in promoting the use of the term "liberalized depreciation" as distinguished from "accelerated depreciation." Therefore, I deplore Malcolm Davis's use of the term "accelerated depreciation" in the excellent article on the study conducted by his organization on the tax benefits available from the liberalized procedures, as reported in Electrical World of February 10th at page 97.

H. J. Flagg
State of New Jersey
Department of Public Utilities
Newark 2, New Jersey

USE POSTAL ZONE NUMBER

NEW YORK 36, NEW YORK

That's our postal zone number, between the city and the state. If you always include your zone number, when writing, changing your address or renewing subscriptions, we can get our replies and publications to you faster.

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LET US PROVE WE HAVE A BETTER ~~MOUSETRAP~~ Distribution Clamp

NEW Extruded Aluminum Clamps For Copper and Aluminum Conductors

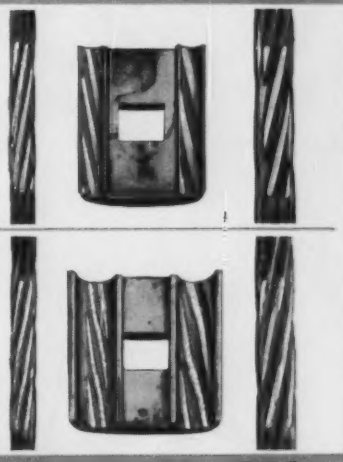
- SINGLE BOLT CONNECTION
- NO COPPER LINERS
- CAPTIVE PARTS
- EASY INSTALLATION
- EXCELLENT CONDUCTIVITY
- LONG SERVICE LIFE
- AVAILABLE WITH NO-MELT INHIBITOR

Extensive tests uphold the design of these Reliable Clamps — the use of extruded shapes, the mass anode principle and a single hex-head bolt. There is plenty of metal with lots of space between conductors. Clamps are tightened with wrench against wrench.

STRAND CONTACT

Picture shows strand contact area in the Reliable Distribution Clamp. Tightened to normal torque, every one of the six outer conductor strands has adequate contact area at sufficient pressure to maintain current carrying ability even for overload and fault current conditions. Strands were treated so contacts would show.

Available in three sizes for conductors 6 to 1/0, 2 to 4/0 and 1/0 to 336.4



Write for supporting data and sample clamp to suit your conductor.

Reliable ELECTRIC COMPANY • FRANKLIN PARK, ILL.

A HALF CENTURY OF SERVICE TO THE UTILITIES

ELECTRONIC TESTING... BY PUSH BUTTON!

Patent applied for.

Yes, just push a button and automatically, Moloney Distribution Transformers are Tested, Proved and on their way ... all neatly crated, of course ... to your utility.

Our automatic testing system, applied to our enlarged production facilities, guarantees production of Moloney Transformers of the quality you want, in the quantities and ratings you want.

Control room for the automatic test system contains equipment which automatically records test data for each transformer as it goes through the test area.

MEES-14

Manufacturers of MOLONEY ELECTRIC® *Transformers for Utilities, Industry and Electronic Applications*

SALES OFFICES IN ALL PRINCIPAL CITIES

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA